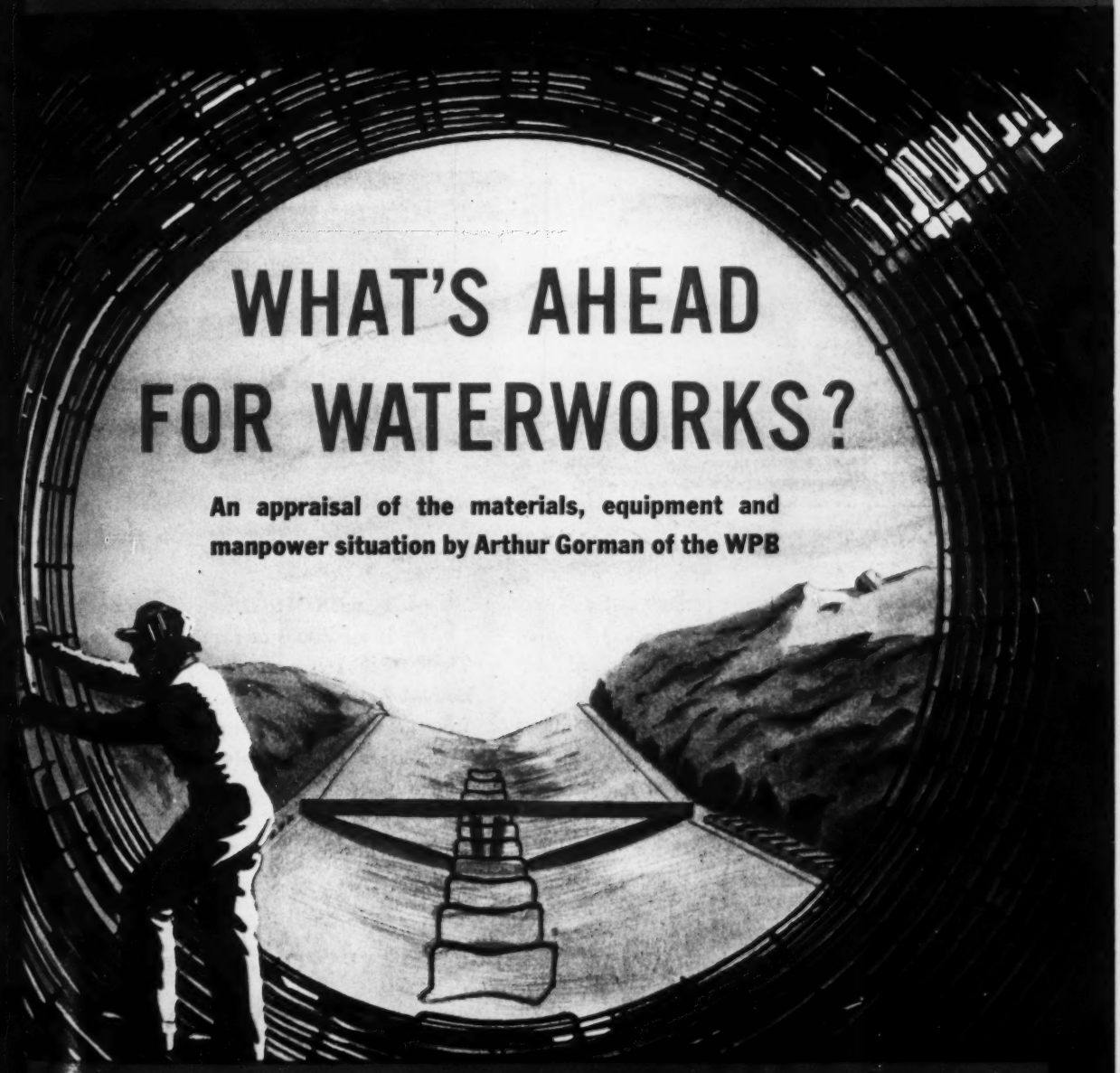
JUN 6 1944

ENGINEERING
NEWS-RECORD

JUNE 1, 1944



WHAT'S AHEAD FOR WATERWORKS?

An appraisal of the materials, equipment and manpower situation by Arthur Gorman of the WPB

ALSO IN THIS ISSUE . . . A JOB FOR "SKYHOOKS" IN ALASKA

★

Free Your Sewerage Systems

FROM THESE HAZARDS

Part of 18,000-ft. line of 36-in. ARMCO Paved Invert outfall sewer across swampy ground near Newport News, Virginia, carries treated sewage.

As you plan your sewerage projects for postwar construction, remember that by using Asbestos-Bonded ARMCO Sewer Pipe you can gain these four important advantages:

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Buy More War Bonds

ASBESTOS-BONDED

Armco Sewer Pipe

CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

Postwar Projects Proposed Top $8 Billions

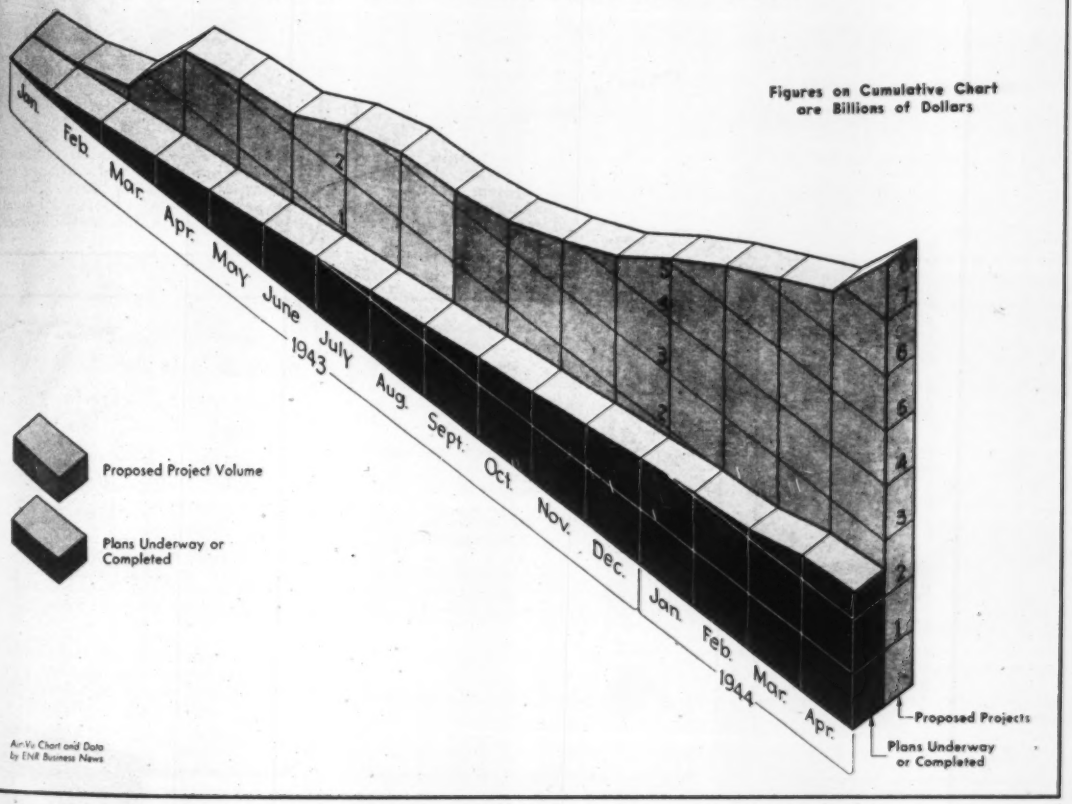
IN THE sixteen months since January, 1943, $8,028,114,000 in proposed postwar construction projects have been reported to *Engineering News-Record*. Of this volume, $2,306,552,000, or 28.8 percent, have plans underway or completed.

These planning stage projects, the real measure of prospective postwar construction employment, are expected to produce 1,153,276 jobs, one-third at the site and two-third in factories, mines, forests, etc., producing or prefabricating construction materials and equipment. The volume proposed to date would provide 4,014,057 jobs should all projects mature into planned volume.

Of the proposed project volume, $386,302,000 is in New England (29 percent in planning stage); $2,419,607,000 in Middle Atlantic (34 percent in planning stage); $447,634,000 in the South (26 percent in planning stage); $1,518,100,000 in Middle West (38 percent in planning stage); $1,527,698,000 in West of Mississippi (31 percent in planning stage); and $1,728,773,000 in Far West (12½ percent in planning stage).

POSTWAR ENGINEERING CONSTRUCTION PLANNING PROGRESS

Proposed Project Volume and Plans Underway or Completed as reported to Engineering News-Record from Jan. 1943 through April, 1944



Air-Vu Chart and Data by ENR Business News

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LIFE STORY OF A DARLING HYDRANT

1. FAMILY TREE—Latest in a long line of successful hydrants, and a member of a distinguished family.

2. BORN in Engineering Department of Darling Valve & Manufacturing Co. Designed by experienced engineers who know hydrant problems.

3. FIRST JOB—Picked by waterworks engineers who examined every good make of hydrant, compared them all critically before choosing Darling.

4. SET OUT IN THE WORLD—Equipped with threading to meet customers' exact specifications. Carefully inspected and checked to insure arrival at place of installation in perfect working condition.

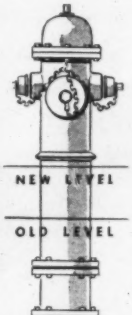
5. WENT TO WORK—Arrived on the job early, took rough treatment from installation crew, survived all the bumps without a whimper.

6. MET PUBLIC APPROVAL—Inspected by citizenry, who commented on sturdy, attractive appearance. Typical remark of a voter, "The city's certainly done a good job this time."

7. FAST ACTION SAVED LIFE—When the Wells' house caught fire, little Mary was trapped in her room. Fireman said, "Lucky that hydrant works so easy. We sure put plenty water in there quick. Pressure never down a second."

8. HIT BY CAR—Slippery street caused auto to jump curb and crash the hydrant. Took the body blow . . . Home owner nearby, who looked for flood, glad Darling hydrants are flood-proof.

9. SILVER ANNIVERSARY—Young fellow on routine inspection removed the working assembly: "What do you know?" he said to himself, "This hydrant's been on the job twenty-five years. Still looks good as new."



10. HAD AN OPERATION—When the city regraded the streets, and raised the level twenty-four inches, a new section was bolted in the old hydrant in less than an hour. Still just as good as new.

11. VETERAN OF MANY WINTERS—Year after year the Darling Hydrant goes on giving efficient, instant service. In toughest winter it never freezes. Maintenance and repairs are negligible. Tax payers credit city council with smart administration. Waterworks superintendent who installed the hydrant, retiring, at testimonial dinner said, "Guess we'll never retire *that* hydrant."

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

Blueprint for tomorrow's needs Now!

NGINEERING NEWS-RECORD

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

132 June 1, 1944 No. 22

MING NEXT

ce the very beginning of the Great Britain has been planning eace. As a result, now that vic- is in sight, Britain has many of ostwar objectives outlined, its reconstruction machinery or- d, and is getting down to de- For the June 15 issue, Waldo an, editor of *ENR*, has pre- an interesting and stimulating e on the progress of Great in's postwar program. In con- to our own efforts to set up a program, the British program much of value for our postwar ers.

new type of movable bridge kewed crossings will be de- d in *ENR* for June 15. The n offers one of the most feasible economical solutions, yet de- d, to a difficult problem. The ure is a twin single-leaf bas- and was built at a saving of than $300,000 over the next logical layout. Two bridges of ype are now being designed as ar projects for New York City.

al completion of the Overseas way from the Florida mainland y West, much of it following ight-of-way of Flagler's aban- East Coast Railroad, involved nber of unusual and interesting ems. Modification of 19 rail- bridges to highway structures, uction of four new crossings, mprovement of 91 miles of rail- right-of-way—with a concrete are among the features that will scribed in our June 15 issue.

OKING AHEAD

e northern road to Tokyo fol- the 2,000-mile sweeping curve e Alaska Peninsula and the ian Islands. Along this road en- rs of our armed forces built a of airports on the barren Arctic that may well form steel- steps to the Jap homeland. ifficult problems involved and ur engineers kept in step with sk forces, as they moved west- to push the Nips out of the ans, will be told in an early by H. W. Richardson, *ENR* n editor, who recently com- a tour of inspection of our ian bases.

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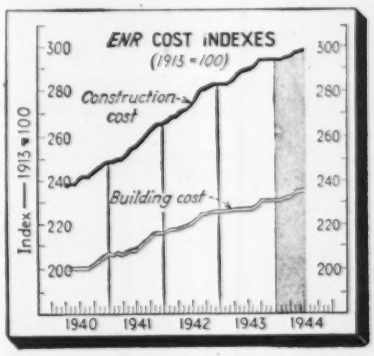
ONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(.000 omitted)	May 1943	May 1944	% Change	Five Months 1943	Five Months 1944	% Change
U. S. Construction	$273,650	$138,857	−49.0	$1,491,759	$734,019	−51.0
Construction	22,014	42,923	+95.0	149,766	168,912	+13.0
Construction	251,636	95,934	−62.0	1,341,993	565,107	−58.0
	228,987	71,458	−69.0	1,263,588	487,358	−61.0
New Productive Capital	$13,143	$60,914	+363.0	$492,422	$426,549	−13.0
Investment	12,643	21,480	+70.0	79,939	127,503	+60.0
(non-federal work)	500	.....	.....	12,133	53,780	+343.0
(federal work)	.....	39,434	.....	400,350	245,266	−39.0
Construction Volume Index, 3 = 100	203	100	−51.0	265*	127*	−52.0

* Five-month average.



CONSTRUCTION COSTS . . . . WAGE RATES . . . MATERIAL PRICES

	June 1943	June 1944	% Change	Change May to June 1943 May	1943 June	1943 %	Change May to June 1944 May	1944 June	1944 %
Construction Cost et. 1913 = 100‡	289.94	298.72	+3.0	289.87	289.94	†	298.00	298.72	+0.2
Building Cost Index, 3 = 100‡	227.71	235.33	+3.4	227.64	227.71	†	234.80	235.33	+0.2

‡ Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.

ENR 20-CITIES' AVERAGE

non Labor	$0.863	$0.877	+1.6	$0.863	$0.863	0	$0.874	$0.877	+0.3
d labor (av. 3 trades)	1.614	1.638	+1.5	1.614	1.614	0	1.632	1.638	+0.4
layers	1.703	1.736	+1.9	1.703	1.703	0	1.726	1.736	+0.6
ural ironworkers	1.671	1.694	+1.4	1.671	1.671	0	1.688	1.694	+0.4
enters	1.468	1.484	+1.1	1.468	1.468	0	1.481	1.484	+0.2
nt, per bbl	$2.61	$2.65	+1.5	$2.61	$2.61	0	$2.64	$2.65	+0.4
oreing steel, cwt	2.73	2.79	+2.2	2.74	2.73	−0.4	2.79	2.79	0
ural steel, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
per ton	1.21	1.23	+1.7	1.21	1.21	0	1.23	1.23	0
er, 2x4 Fir, per M ft.	51.13	54.28	+6.2	50.88	51.13	+0.5	54.07	54.28	+0.4
er, 2x4 Pine, per M ft.	44.85	52.68	+17.5	44.97	44.85	−0.3	52.68	52.68	0
, common, per M	15.68	16.41	+4.7	15.68	15.68	0	16.45	16.41	+0.2
y-mixed concrete, c. y.	7.37	7.39	+0.3	7.37	7.37	0	7.39	7.39	0
t. clay tile, 3x12x12-in.	78.97	79.97	+1.3	78.97	78.97	0	79.64	79.97	+0.4
g asphalt, cars, ton	15.32	15.25	−0.5	15.32	15.32	0	15.25	15.25	0

† Less than .05 percent change

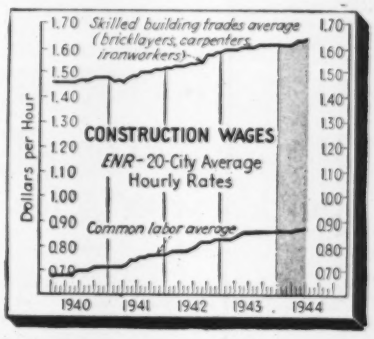
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
June, 1944	298.72	143.59	235.33	127.21	....	....
May, 1944	298.00	143.25	234.80	126.93	100	44
April, 1944	297.70	143.10	234.50	126.76	106	46
Mar., 1944	295.34	141.97	232.32	125.59	103	45
Feb., 1944	295.05	141.83	232.03	125.43	86	38
Jan., 1944	294.57	141.60	231.55	125.17	114	50
Dec., 1943	294.51	141.57	231.49	125.14	103	45
Nov., 1943	294.41	141.52	231.39	125.08	149	65
Oct., 1943	294.31	141.47	231.29	125.03	142	62
Sept., 1943	294.09	141.37	231.20	124.98	155	68
Aug., 1943	291.38	140.07	228.49	123.51	119	52
July, 1943	289.92	139.36	227.89	123.19	175	77
June, 1943	289.94	139.37	227.71	123.09	204	89
May, 1943	289.87	139.34	227.64	123.06	203	89
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118

MATERIAL SHIPMENTS . . . . . BUILDING PERMITS

	May 1943	May 1944	% Change	Apr. 1944	% Change Apr.-May
(% operating capacity) A. I. S. I.	98.9	99.1	+0.2	99.4	−0.3

	April 1943	April 1944	% Change	Four Months 1943	Four Months 1944	% Change
cated structural steel, tons, A. I. S. C.	86,564	37,465	−56.7	363,270	152,717	−57.9
nt, thous. bbl., U. S. B. of M.	12,757	7,373	−42.2	40,161	23,700	−41.0
ing permits, 215 cities, Dun & Bradet (.000 omitted)	$49,804	$44,790	−10.1	$142,046	$194,800	+37.1



COST OF LIVING INDEXES . . . . EMPLOYMENT

	April 1943	April 1944	% Change	Mar. 1944	% Change Mar.-Apr.
of Living Index, N. I. C. B.	104.0	104.1	+0.1	103.4	+0.7
(Housing) Index, N. I. C. B.	90.8	90.8	0	90.8	0
Employment (est.), thous., B. L. S.	39,708	38,383	−3.2	38,550	−0.4
r. Employment (est.), thous., B. L. S.	1,402	672	−52.0	674	−0.3

ENGINEERING CONSTRUCTION CONTRACTS—ENGINEERING NEWS-RECORD—MAY, 1944

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States May 1944	United States Five Months 1944	United States Five Months 1943	Canada
c Works										
Waterworks	132	231	254	216	338	388	**1,559**	**9,613**	23,084	138
ewerage	63	277	351	363	55	174	**1,283**	**9,143**	16,895	90
Bridges, public	.....	131	404	37	84	.....	**656**	**3,385**	8,470	90
Earthwork and waterways	147	177	252	25	294	1,458	**2,353**	**22,348**	16,469	.....
Streets and roads	309	4,312	5,067	4,780	5,142	2,820	**22,430**	**67,415**	96,836	561
Buildings, public	1,442	4,485	7,387	3,382	1,745	17,661	**36,102**	**288,886**	730,608	1,355
Unclassified, public	977	3,946	3,108	306	2,076	21,138	**31,551**	**164,317**	449,631	4,545
public	**3,070**	**13,559**	**16,823**	**9,109**	**9,734**	**43,639**	**95,934**	**565,107**	**1,341,993**	**6,779**
Federal government (included in above classifications)	2,633	8,536	11,147	3,595	4,221	41,326	**71,458**	**487,358**	**1,263,588**	.....
e										
Bridges, private	.....	50	125	.....	280	.....	**455**	**1,325**	2,150	.....
Industrial buildings	525	7,240	407	3,968	3,360	8,585	**24,085**	**70,914**	48,881	1,622
Commercial buildings	150	2,598	1,762	650	2,418	3,814	**11,392**	**78,556**	84,295	391
Unclassified, private	88	449	2,405	290	1,937	1,822	**6,991**	**18,117**	14,440	290
private	**763**	**10,337**	**4,699**	**4,908**	**7,995**	**14,221**	**42,923**	**168,912**	**149,766**	**2,303**
Engineering Construction:										
1944 — 4 weeks	**3,833**	**23,896**	**21,522**	**14,017**	**17,729**	**57,860**	**138,857**	.....	.....	**9,082**
1944 — 4 weeks	4,656	21,689	27,431	24,957	19,070	47,237	**145,040**	.....	.....	6,720
1943 — 4 weeks	14,784	27,643	72,866	51,963	59,660	46,734	**273,650**	.....	.....	13,097
Months — 1944	**20,886**	**112,404**	**120,847**	**88,065**	**109,267**	**282,550**	.....	**734,019**	.....	**32,944**
Months — 1943	68,299	193,531	350,826	191,919	336,706	350,478	.....	.....	1,491,759	44,714

One-mile section of State Road No. 204, Duval Cou
Florida, leading to a naval air field. Designed
State Road Department of Florida, Division Of
Lake City. Contractor, Ivy H. Smith Company, Jackson

Highway to naval air field completed quickly with Atlas High-Early Cement

FLORIDA State Highway Department specifications call for fourteen days curing time when normal portland cement is used; but this new highway had to be opened quickly to give access to a naval air field.

That is why Atlas High-Early cement was chosen, and this important mile-long stretch of road, built by Ivy H. Smith Company of Jacksonville, was opened three days after concrete was placed—a saving of eleven days.

When speed is needed in construction work, contractors know they can depend upon Atlas High-Early cement to save time and to help them meet or beat schedules.

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1. ***Permits earlier use*** of concrete, and thus gives owner earlier occupancy.
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3. ***Conserves lumber.*** Forms may be stripped sooner—sometimes in 24 hours instead of from 3 to 5 days—and re-used. Hence fewer sets of forms may be needed, saving time, labor and lumber.
4. ***Reduces overhead*** by saving time, manpower and equipment.

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The Week In Engineering and Construction

GINEERING NEWS-RECORD • JUNE 1, 1944 • VOLUME 132 • NUMBER 22

New bill cuts down roads program by $1½ billion

Representative Robinson, chairman of Roads Committee, introduces new bill in House before original measure is reported out by committee

Representative Robinson of Utah, chairman of the House Roads Committee, May 22 introduced into Congress a bill authorizing $1,500,000,000 for postwar road construction—an amount which is just half that proposed in Mr. Robinson's original bill, H.R. 2426. The latter, together with other similar bills, has been the subject of extensive hearings before the House Roads Committee. The committee was due to draft a new bill, and it is understood that Mr. Robinson, at the close of hearings, presented to the committee a version differing in some respects, but retaining the original $3,000,000,000 figure. It seems, however, that the committee took exception to the amount, in view of the federal deficit.

Thus, with the authorization cut to $1,500,000,000, the bill, it is understood, was approved section by section by the committee in executive session. Then, contrary to custom, it was introduced on the floor of the House without first being reported out by the committee.

A third bill also introduced

When it appeared that the amount of the authorization was to be cut, one member of the committee, Representative Mott of Oregon, introduced in the House a bill of his own, H.R. 4811, which differs from the new Robinson bill mainly in that it retains the $3,000,000,000 figure.

Neither the American Association of State Highway Officials, which sponsored the original legislation, nor the Public Roads Administration had any comment to make concerning the change in amount. Both agree, however, that early action by Congress on some road legislation is of foremost importance. The Robinson $1,500,000,000 bill makes $500,000,000 available for each of the first three postwar years, with not more than $200,000,000 immediately available for construction after the war. Each year $225,000,000 would be available for federal aid roads in or outside of municipalities of 10,000 or over; $125,000,000 for "principal secondary and feeder roads" in or outside of municipalities of less than 10,000 population, and $150,000,000 for principal highways in the federal aid system, in urban areas. Amounts apportioned would not lapse for two years.

Of the $1,000,000,000 a year for three years provided by the Mott bill, $450,000,000 would be for federal aid in or out of municipalities; $250,000,000 for secondary and feeder roads either outside of municipalities or inside those of less than 10,000 population; and $300,000,000 for principal highways in urban areas, either on or off the federal aid system.

Allocation basis changed

Both new bills allocate funds on the basis of one-third each on population, area, and postroad mileage, both for federal-aid roads in or outside, of municipalities, and for secondary and feeder roads; and on a basis of population for roads in urban areas.

H.R. 2426 divided funds one-half for federal aid highways, and one-half for

(*Continued on next page*)

Wide World photo

Cleveland wind tunnel to permit advanced work

An altitude wind tunnel, believed to be the first of its kind in the world, has been placed in operation at the Aircraft Engine Research Laboratory in Cleveland, Ohio. The structure is expected to be a valuable unit to the nation's aeronautical research facilities, having been rushed to completion for investigations of new military power plants, including jet propulsion systems.

The tunnel is said to be the first of its kind for investigating, under altitude conditions, aircraft power plants as installed in airplanes. It is the most complete equipment as yet developed for getting the "bug" out of entire power plants designed for high altitude operation before the airplane goes into production, according to official reports.

The 28-ft. diameter of the test section will permit engines of 3,000 hp. or greater to be tested. The structure is designed to simulate the sub-zero temperatures encountered at 30,000 ft. and low pressures encountered at 50,000 ft. An 18,000-hp. electrical motor driving a 31-ft. diameter, 12-bladed propeller on an extension shaft from outside the tunnel shell creates the desired wind velocity.

Built of an alloy steel especially adapted to temperature changes, the tunnel is supported on steel rollers to provide for expansion and contraction of the shell in any direction. Heat losses are minimized by an insulating layer of glass wool, which in turn is enclosed in a steel cover.

The structure was built under the direction of the National Advisory Committee for Aeronautics. Pittsburgh-Des Moines Steel Co., with L. A. Idle in charge of construction, was the general contractor.

secondary and feeder roads and for projects in urban areas. And it allocated money on a basis of one-half on population, and one-fourth each on area and postroad mileage.

Both new bills would make apportionment to the District of Columbia, Hawaii, and Puerto Rico in the same ratio as to the states. This provision was not included in H.R. 2426. The Mott bill adds that Alaska's share for federal aid would be one-half of one percent of the $450,000,000 to be apportioned for such roads, and that Alaska would not be required to match funds.

Matching federal funds

In the matter of matching federal with state funds, H.R. 2426 proposed that 75 percent of cost be borne by the federal government, while the new Robinson bill proposes 60 percent federal funds the first year, and 50 percent the second and third years; and the Mott bill makes it 75, 60, and 50 percent, respectively for the three postwar years.

Because some members of the committee thought the term "Interregional Highway System" was misleading, the name of that proposed system is changed in both new bills to "National System of Interstate Highways." The Mott bill adds that, after three years, federal participation in payment of cost of construction of this system will be conditional on a state's having established its right to control access to the system by purchase or condemnation.

Money for planning

One and one-half percent of any year's apportionment can be used, according to the new bills, with or without the addition of state funds, for engineering and planning "for future construction." This was not provided in the original bill. Another addition in both bills is the provision that money authorized can be used for flight strips adjacent to highways.

The provisions of H.R. 2426 concerning rights-of-way are retained in the Mott bill, but omitted from the Robinson bill. They made federal funds available for acquisition of rights-of-way; and authorized the Federal Works Administrator to acquire land by condemnation for projects under the proposed act. In addition, the Mott bill makes $100,000,000, of the $3,000,000,000, immediately available—upon apportionment of funds for the first year—for surveys and plans, and acquisition of rights-of-way.

Railroad grade separations

A provision of the new bills, not included in the original, is that the entire construction costs of railroad grade separations may be paid for from federal funds, but not more than half of the right of way costs for such separations can be so paid.

The original measure made funds available for purchase of land and construction of off-street parking facilities; and for facilities to give access to transportations terminals. The Mott bill modifies this provision by making funds available only for off-street parking, and solely for purchase of land for such facilities. This is in line with Mr. MacDonald's position that the only justification for putting federal money into off-street parking is to provide these facilities in congested city areas where high land values prevent private enterprise from providing parking areas. Mr. Robinson's new bill omits these provisions altogether.

New to the Robinson and Mott bills are specific authorizations for appropriations for special types of roads. The Robinson bill authorizes $25,000,000 a year for three years for forest highways, $12,500,000 for forest development roads and trails, with Alaska's apportionment limited to $1,500,000; $4,250,000 a year for national park roads, and $5,000,000 for parkways. The Mott bill increases the Alaska figure to $2,000,000 and doubles the other amounts.

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Postwar house estimates too high, realtors claim

That the huge estimates of housing to be built in the postwar period may be much too high is the conclusion of the 42nd semi-annual survey made by the National Association of Real Estate Boards and published on May 27.

Replies from 376 cities in all parts of the country indicated that the number of houses which actually might be built would average around 300,000 annually for the first ten postwar years.

This is in sharp contrast to other current estimates of potential house construction, some of which average more than 1,000,000 units a year. Carefult checking in their own communities by local real estate boards, the association reported; disclosed that such estimates probably were running three times too high.

Representing a check on almost half of the urban population of the country, the realty figures place the number of houses which actually may be built at one for every 227 fa lies. They show the number of units expected to be built annually as averaging 4.4 units per 1,000 of urban population. Applied to the nation, the figures would indicate a yearly postwar building total of approximately 303,000 dwelling units for the urban areas.

Fleming asks $200,000,00 to finance postwar plans

Maj. Gen. Philip B. Fleming, feder works administrator, recently recommended to Congress an additional a propriation of $200,000,000, to matched 50–50 by local government for postwar public works planning. H recommendation was made before t house special committee on postw economic policy and planning.

Such a sum, he said, is urgent needed in addition to the $500,000 ready appropriated for the same pu pose to the Public Buildings Admini tration—and the $60,000,000 to the Pu lic Roads Administration.

In response to a question, Gen. Fle ing said that while he is in gener accord with the idea of setting up pla ning boards, he does not believe th is the time to do that because it wou cause delay in planning and, added, "we are faced with an eme gency, as I see it."

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N. Y. housing body build 14 projects in 10 years

When the New York City Housi Authority celebrated its tenth birthd recently, Chairman Edmund E. Butl reported that the authority had built projects accommodating 60,000 perso and that New York postwar plans c for 13 more to rehouse more than 68,0 persons. The authority, he said, h done its job, while saving funds. La year, out of a possible $1,368,000 fe eral subsidy for six projects, it turn back to the federal government $628,0 from operating income.

With WPA assistance, a total 50,000 substandard, unsafe and insa tary dwelling units have been clear away, including 18,280 on the sites the housing projects. Chairman Butl reported previous homes of 34.7 pe cent of the tenants now housed in au ority buildings had had major fire ha ards; 68.5 percent no private bath 61.5 percent no central heat; near one-half no private indoor toilet; a about one-third windowless interi rooms.

Mr. Butler foresaw postwar housi costs rising to $6,400 a family, $1,600 a room because land will ha to be bought in areas of higher price To date the average development cost New York, excluding two Public Wor Administration projects, has been $ 852 a family or $1,315 a room, wh construction costs alone have been $ 335 a family or $904 a room. Mr. Butl urged a large private housing progra because public housing necessarily limited.

outhern California postwar planning iscussed at local A.G.C. meeting

harles H. Purcell, director of the state's public works, says that ans must be made now for the transition period to come

stwar construction planning in hern California was given great etus at a recent dinner meeting in Angeles, sponsored by the Southern fornia chapter, Associated General tractors of America, and attended 500 persons, including 200 leading lic officials, business men and in- rialists of the area.

hairman Charles H. Purcell and ctor Alexander R. Heron of the fornia State Reconstruction and mployment Commission, and F. J. nolly, chapter manager, were the cipal speakers. Mr. Purcell, who he director of public works for fornia and well known as an en- er, said:

While the best efforts of the en- nation must be given to successful ecution of the war, there is no on why plans may not be made for a course of action by which transition from war may be bridged peacetime economy."

Needed for national economy

Mr. Purcell described the role of lic works "as a factor in maintain- a stabilized national economy to alize the variations in private construction so that the total volume of all construction might more nearly approach a constant value." Such stabilization, he added, "would assist in maintaing full employment."

The speaker declared the California division of highways is preparing plans for an $80,000,000 postwar highway program, and other state agencies have postwar projects in the planning stage for $28,000,000 more.

Time to start work

Director Heron analyzed California's postwar employment problem, declaring:

"The construction industry is challenging business and other industry, realtors and public officials, to bring their dreams down to the drafting table. We are not really planning until draftsmen and engineers have put pencils to paper."

Manager Connolly of the Southern California chapter presented its analysis of the wartime transformation of the area and the problem it poses for the postwar transition. Mr. Connolly stressed the point that it takes longer to plan than to build, illustrating by a chart that in the case of public works the average time for preliminaries is 2½ times longer than the actual construction period.

He divided the principal postwar construction markets into commercial and industrial building, home building, and public works, and declared "We believe that construction should be on an investment basis; that there should be a full play of the forces of competition which have placed America far ahead of the world in the speed, economy and efficiency of her construction methods." He estimated the postwar home building market in Southern California at from 40,000 to 50,000 homes per year, representing a construction volume of more than $200,000,000 annually. The size of the industrial conversion task was illustrated by a chart showing the total investment in industrial facilities in Los Angeles County during the three war years, 1940 to 1943, to be $351,600,000, of which $220,000,000 was government funds.

Mr. Connolly urged public officials to appropriate sums this year to provide plans, specifications, sites and rights-of-way for urgent postwar projects, and urged the proprietors of industry and commerce to engage architects and engineers to complete preliminaries for actual construction.

ey discussed Southern California's construction plans

t the speaker's table at the recent din- meeting of the Southern California chap- of the Associated General Contractors e, from left to right: Seated; E. S. McKit- , president Southern California chapter; cher Bowron, mayor of Los Angeles; xander R. Heron, director of State Reconstruction & Reemployment Commission; Laurence Olson, president, League of California Cities; standing; Charles H. Purcell, Chairman State Reconstruction and Reemployment Commission; R. J. Connolly, manager, Southern California Chapter; and James L. Beebe, citizens' tax committee.

* * *

Adirondacks highway sought by Senator Mead

Senator James M. Mead of New York State expects to submit to the Public Roads Administration shortly maps and plans for a superhighway to cut through the Adirondack Mountains region in the northern part of the state.

The plan has the tentative approval of President Roosevelt, Mead said. He will propose that it be built as a postwar project to open more of the Adirondack recreational areas to motorists, to provide more ready access to iron ore deposits and because it would have some strategic military value. Present plans are for a divided highway, probably of four lanes, two to be used exclusively for commercial purposes and the other two for recreational drivers.

The proposed superhighway would be part of a larger program for future Adirondacks development. The rich iron ore deposits of the area are considered to have potential benefits for the western New York steel industry.

The new highway probably would cut through the middle of the Adirondacks, starting at Utica, and would have feeder roads leading into the White Mountains of Vermont and the Laurentians in Canada.

Cement required in 1944 half of that in 1943

Slightly more than half as much portland cement as was used in 1943 will be required during 1944, according to estimates made by the construction research section of the statistics division of the War Production Board. Whereas 127,567,000 bbls. were used in 1943, the 1944 estimate is 70,788,000.

This year's figure includes 66,338,000 bbls. for the continental United States and 4,450,000 for shipments to Alaska, Hawaii, Puerto Rico, Canal Zone, Foreign countries, and for construction outside the continental United States. The construction research section says that part of this cement will be procured outside the United States. It is understood, however, that, as in the past, local supplies will be used in the war zones wherever they are available.

"It is regarded as unlikely," says the WPB report, "that actual requirements in 1944 will prove to be materially lower than the estimates. Consumption might run higher, depending on possible increases in use for maintenance and repair, or in the event that the war situation might permit more new construction than has been estimated."

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Survey to be made for Baltimore's freeway

The Board of Estimates of Baltimore, Md., on May 19 approved an appropriation of $75,000 to match Federal funds for making a survey of the proposed mid-city freeway. The State Roads Commission will advance the money to Baltimore from the city's share of 1945 gasoline and motor vehicle tax funds.

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Tar tank permit rule revoked by PRA

Tar can now be transported by tank cars and tank trucks without the encumbrance of the permit system set up last year by the Public Roads Administration. The purpose in revoking the system is to facilitate shipment so that tanks will be more constantly available to meet transportation needs in connection with an expected increase in highway construction and repair.

As a further measure in keeping tanks moving, Col. J. Monroe Johnson, director of the Office of Defense Transportation, urged state highway officials to "streamline testing processes so that tank cars and trucks would not be held up pending certification of their contents." Such certification is now required by the various states.

The PRA permit system has been revoked in respect to shipment of asphalt, as well as tar, and Colonel Johnson has made recommendations concerning quick testing of asphalt, in addition to his recommendations for tar, in order to keep tanks moving. (ENR p. 720, May 18.)

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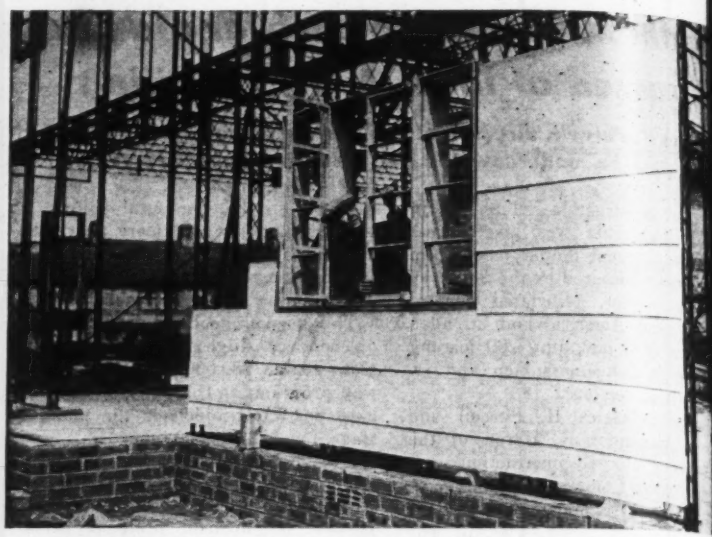
Extensive subway plan offered for Montreal

At the request of the Greater Montreal Economic Council, and after a year's study by its staff assisted by the Chicago firm of DeLeuw, Cather and Co., the Montreal Tramways Co. has prepared a plan for a $60,815,000 subway system to serve the city of Montreal, Que. There will be a 5½-mi. north-south line and 2⅓-mile east-west line.

It would require approximately four years to build and equip these lines for operation, according to R. N. Watt, president of the tramway company. The two initial routes fit into a comprehensive pattern of subways, which when completed, "will provide all of the trunk line subway operation necessary for efficient coordinated transit in Montreal for a number of years," Mr. Watt says.



Steel frame houses being built in Birmingham, Engla

Faced with the necessity of providing 15,000 to 20,000 houses at once, apart from future requirements, Birmingham, Eng., acting on the advice of its city engineer, has undertaken a new type of building in which prefabrication is used as extensively as is considered practicable. The structure consists of a light steel frame within which a permanent house interior can be construct with any suitable material, prefabricated other. Exterior materials can be of a t porary or permanent character as desi Temporary materials can easily be remo and permanent materials substituted as t become available and the building inde becomes stabilized.

Many additional projec for N. Y. City and State

The New York State Postwar Pub Works Planning Commission announc May 16 that it had approved 850 ad tional projects for New York City, t construction cost of which is estima at $38,000,000. The commission a located $519,270 to pay one half t cost of the preparation of the plans.

This makes a total of 1,608 proje the commission has approved for t city, to cost $73,000,000. The comm sion has allocated $1,000,000 to p the state's share of the cost of the pla This program is made up of relati small construction jobs which will p vide work for a large number of s skilled and semi-skilled workers.

Additional allocations have also be made by the commission for work various other parts of the state, the to cost involved being $6,994,323, t state's share of the cost of plans be $109,542. Among the larger proje are: County-wide drainage in Nas County, $2,933,000; road reconstr tion in the same county, $1,608,900; placement of nine bridges in Mon County, $330,000; and twenty-four br bridges in Niagara County, at a cost $253,000.

Activity on the Postwar Front

Highway construction and repair seem to lead in postwar plans through the ntry, many of them being contingent upon road legislation now being con- ered in Congress. Herewith are summarized some of those tentative plans, l also a number of projects in other construction classifications.

HIGHWAYS

Michigan—Charles M. Ziegler, state hway commissioner, says that cities, nties, and the highway department e a $433,000,000 postwar construc- program with surveys and plans mpleted for about 10 percent. Proj- s included are the John C. Lodge and osstown expressways in Detroit.

Illinois—In the highway department construction program of $114,000,000 in process. Of this 30 percent is in contract-letting stage. The entire ogram will cost $371,000,000.

Houston, Tex.—The postwar plan- ng committee has chosen Glen R. ackburn, highway engineer for the ouston Chamber of Commerce, to be engineering director.

Wisconsin—The highway commission planning improvements of 1,260 miles road at a cost of $70,385,000.

Arizona—The Public Roads Admin- tration recently allocated $492,746 in deral funds, to be matched by $239,- 4 in state funds, to aid in the prepa- tion of plans, specifications and timates for postwar highway construc- n. Bernard Touhey, state engineer, ys the highway department will have mpleted by July 1 plans for 44 proj- ts involving $12,800,000 and that ,000,000 worth of additional projects ill be nearing completion.

North Carolina—W. Vance Baise, hief engineer of the highway depart- ent, says that about $175,000,000 ould be needed to improve the state's rimary and secondary road system to ring it up to the standards to be re- uired by postwar traffic. The division statistics and planning estimates 2,332,500 as the cost of the construc- on equipment needed to put the high- ays back into condition.

Arkansas—The state is building up a serve of $5,000,000 to match federal nds for highway construction in the rst year after the war. A total of 60,000,000 will be spent for highways.

New York State—Laws have been acted transferring from the counties the state the cost of acquiring rights- f-way for state highways, and provid- ing for state payment of the cost of plans for postwar construction of city arterial highways.

Westchester County, N. Y.—The board of supervisors has pledged itself to give to the state the Pelham-Port Chester Parkway right-of-way for development of an arterial highway after the war. The property, acquired by the county fifteen years ago but never used, is ten miles long and to date has cost $8,000,000 in purchase charges and bond interest.

PUBLIC BUILDINGS

Pittsburgh, Pa.—A plan for a river-rail-highway terminal for freight has been announced by a Chamber of Commerce committee headed by Charles S. Donley. It would cost $300,000 to be financed by bonds based on the terminal's revenue. The proposed site is on the Ohio River between the McKee's Rocks Bridge and the Western Penitentiary.

Tallahassee, Fla.—Construction of a municipal hospital is the city commission's No. 1 project for the postwar period.

WATER AND SEWERS

Iowa—A. H. Wieters, state sanitary engineer, says that necessary expenditures in the postwar period for the improvement of water and sewer systems in Iowa cities and towns will amount to $24,000,000.

Kansas City, Mo.—Improvements in the city's water distribution system totaling $1,983,000 have been recommended by the Burns & McDonnell Engineering Co. The recommendations are based on a study of present conditions and probable future requirements. They would bring increased efficiency, and provide for expansion.

AIRPORTS

Pittsburgh, Pa.—The county commissioners have discussed plans with officials of the Civil Aeronautics Authority and members of the county airport committee and county planning commission for a postwar network of airports throughout this entire area. The commissions are particularly interested in linking the Ohio and West Virginia airports with the proposed $12,000,000 Moon Township airport.

Dallas, Tex.—Establishment of a 600-acre, $1,700,000 Oak Cliff airport on the west side of the new Zang Boulevard (U.S.67) at the triple intersection with Redbird Lane and Hampton Road has been recommended to the city council by Master Plan Engineer Harland Bartholomew.

New York City—The necessary legislation has been passed authorizing the city to finance the Idlewild Airport on Jamaica Bay. Idlewild, a super-airport five times as large as LaGuardia Field, will cost $100,000,000. Already $12,500,000 has been appropriated for present construction.

SUBWAYS

Toronto, Ont.—A rapid transit subway system to run north and south, on Yonge Street, the main artery, is being planned. The Toronto Transportation Commission, operating the city's street railway system, has appointed DeLeuw, Cather and Co., of Chicago, as consulting engineers for the design of the project, which is the first stage of a large development. Charles E. DeLeuw of that firm was formerly Chicago's chief subway engineer.

Work has already started on preliminary designs, and plans and specifications will be ready at the end of 1944 so that tenders can then be called within two months if necessary. The estimated cost of the work is about $20,000,000.

HOUSING

New York City—The city housing authority has chosen architects to prepare plans and specifications for six low-rent public housing projects to cost $53,000,000 and to house 8,668 families.

Canada—The housing sub-committee of the advisory committee on reconstruction of the federal government of Canada suggests 731,000 housing units as Canada's need for the next ten-year period, of which one-third should be for low income groups.

DAMS AND LEVEES

Texas—John M. Fouts, general manager of Trinity Improvement Association, said recently that in his opinion Congress would appropriate $23,500,000 as soon as the war ends for levees and dams along the Trinity River. Fort Worth and Dallas will have 100 percent flood protection and control, as well as ample water for domestic uses. There will also be sufficient water for navigation to the two cities.

JOBS OF THE WEEK

AIRPLANE HANGAR and SHOP, Moffett Field, Calif.

National Advisory Committee for Aeronautics, Ames Aeronautical Laboratory, awarded a contract for the construction of an airplane hangar and shop to Carl N. Swenson Co., San Jose, at $695,661.

PILING, DECK and RIPRAP, Alameda, Calif.

U. S. Engineers, San Francisco, Calif., awarded a contract for piling, deck, and riprap at Intransit Depot, to Stolte Inc., Oakland, and Duncanson-Harrelson Co., San Francisco, at $5,810,127.

CAFETERIA BUILDING, Renton, Wash.

Boeing Aircraft Co., Seattle, awarded a contract to build a cafeteria building, equipment building and addition to personnel building to Goerig, Philips & Strand, Seattle, at $957,560.

HOUSING, New River, N. C.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for 200 family dwelling units to V. P. Loftis Co., Charlotte at $562,500.

GRADING, ROADS and SERVICES, Alameda, Calif.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for grading, roads and services and for the relocation of Atlantic Ave. at Naval Air Station to Stolte Inc., Oakland, at $517,500.

BRIDGES, Port Arthur, Ont.

Canadian National Railways, H. A. Dixon, chief engineer, Montreal, Que., awarded a contract for constructing combined timber trestle and steel viaduct, with ore dock structure, to Tomlinson Brothers, Ltd., Toronto. The estimated cost is $500,000.

ADDITIONAL STORAGE BUILDINGS, Montreal, Que.

A. Janin & Co., Ltd., Montreal, Que., has been awarded a contract for additional storage buildings at Ordnance Depot by the Department of National Defense, Ottawa, Ont. The estimated cost is $1,000,000.

STOREHOUSE, San Diego, Calif.

Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded a contract for the construction of a storehouse, at Naval Supply Depot, to Ford J. Twaits, Co., Los Angeles, Calif., at $1,451,175.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 201.

Much building work in Baltimore, Md.

According to the Baltimore "Sun", a $50,000,000 building program is under way and projected in Baltimore and its metropolitan area. It comprises:

Twenty-eight billion dollars of private and public building projects actually under construction.

Eight million dollars of work shortly to be placed under contract.

Twelve million dollars worth of building and engineering projects on the drawing boards of architects and engineers.

Currently, housing operations promoted by private builders and federal agencies total about $25,000,000, going into 6,500 units nearing completion, under way or shortly to be placed under contract.

These operations center in the southern section of the city and northern Anne Arundel County, adjacent to the shipbuilding and ship repair enterprises concentrated at Fairfield, Curtis Bay and Arundel Cove; in East Baltimore, near the Canton, Dundalk and Sparrows Point industrial establishments, and at Middle River.

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Pittsburgh considers public works bond issue

The Pittsburgh, Pa., city council is considering a plan to float a second $1,000,000 bond issue this year. The Department of Public Works would get nearly all the money from the forthcoming issue—$145,000 for sewer reconstruction; $400,000 for asphalt resurfacing; $100,000 for postwar planning; $18,000 for approach spans and roadway reconstruction of Smithfield Street bridge; $10,000 for equipment; $147,000 for street repaving; and $183,000 for 20 trucks and other equipment.

Public works plans reported by Illinois

Proof that plans for immediate post-war construction in the field of public works are being brought to the blue-print stage as rapidly as limited design signing personnel will permit is contained in the April 15 report of the Illinois Post-War Planning Commission.

Municipalities, sanitary districts, park districts, school districts and township throughout the state have reported the following program: (Plans being prepared by the City of Chicago are not included)

Type of Construction	*Estimated Cost*
Street improvements	$37,328,000
Sanitary sewers and stormwater drains	48,184,800
Sewage treatment works	16,877,700
Water supply and distribution	11,034,900
Water treatment	812,800
Public buildings	14,792,700
Bridges and grade separations	19,031,400
Parks and recreational facilities	8,651,000
Airports	4,227,800
Power generating plants and distribution	4,516,000
Other projects	3,573,900
Total	$169,031,300

The present status of the plans for the above work include: 18 percent have detailed plans and specifications completed or in progress; 21 percent have sketch plans completed or in progress; 9 percent of the work has surveys completed or in progress; and preliminary estimates only have been made for the remaining 52 percent.

Reports from 92 of the state's total of 102 counties show the following work to be under consideration:

Type of Construction	*Estimated Cost*
Highways including bridges, grade separations and other structures	$107,602,200
Public buildings	2,817,800
Airports	50,000
Total	$110,470,000

The present status of the plans for this work disclose that detailed plans and specifications have been completed or are in progress on 44 percent of the projects; 23 percent have sketch plans completed or in progress; surveys are completed or are under way on 9 percent of the work, and the remaining 24 percent is in the preliminary estimate stage.

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Minnesota airport law is upheld by court

A taxpayer's act to invalidate the Minnesota state airport law has been decided in favor of the state by Judge Gustavus Loevinger of the Ramsey County District Court. Judge Loevinger ruled that the airport commission is not a private corporation but an arm of the state government, and therefore, state credit can be used to aid it.

OBITUARY

Lyman Griswold, 64, consulting engineer, died in Portland, Ore., May 10. During the first world war he was a major in the U. S. Army Engineers.

James R. Gibson, 69, secretary-treasurer of the Master Builders Association of Boston, Mass., a member of the city planning board, and for many years head of Robert Gibson & Son, building contractors, died at Melrose, Mass., May 4.

George M. Hunter, 69, for eight years vice president of the American Bridge Co., died May 21 at Youngstown, Ohio, four years after he retired. He went to Pittsburgh with American Bridge at 15, was manager of the Youngstown plant from 1901 to 1904, then assistant manager at Ambridge until 1910 when he became manager at Gary, Ind., from 1910 to 1917. He then became operating manager in Pittsburgh until 1932, when he was made vice president.

Harry C. Watrous, 71, retired engineer and former executive of the engineering firm of Robert W. Hunt Co., New York, died May 19. Mr. Watrous took part in the construction of a number of bridges in New England and New York state, and once was on the engineering staff of the Missouri Pacific Railroad.

Dallas D. Pittman, 94, contractor and architect, died at Houston, Tex., recently. Mr. Pittman built hundreds of buildings at Houston and in other parts of the U. S., Mexico and Canada.

Carl George Carlson, 53, civil engineer for Los Angeles County, Calif., died May 9.

Edward H. Cowan, 70, former manager of the Marion, Ohio, Water Co., died May 17.

John O. Burgwin, 50, operator of the J. O. Burgwin Co. for 20 years, died May 19 at Sewickley, Pa. His company built an airfield at Independence, Kan., for the Army, and is building a hospital for the Navy at Norfolk, Va.

News of the Week
Continued on p. 122

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction volume for the short week due to the Memorial Day holiday totals $23,214,000. This volume, not including the construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 78 percent below the corresponding 1943 week's total, below the $27,885,000 reported for the preceding week, and 23 percent below the previous four-week moving average.

Public construction is 61 percent under the week last year due to the 22 percent decrease in state and municipal work and the 65 percent decline in federal volume. Private work is 95 percent lower than in the 1943 week.

The current week's construction brings 1944 volume to $757,233,000 for the 22 weeks, a decrease of 53 percent from the $1,598,632,000 reported for the corresponding 1943 period. Private construction, $171,823,000, is 16 percent under a year ago, and public construction, $585,410,000, is 58 percent lower due to the 2 percent decrease in state and municipal and the 62 percent drop in federal.

In the classified construction groups, gains over last week are in sewerage, and earthwork and drainage. Gains over the 1943 week are in sewerage, bridges, and earthwork and drainage.

New capital for construction purposes for the week totals $948,000, and is made up entirely of state and municipal bond sales. The week's new financing brings 1944 volume to $427,497,000, 13 percent under the $492,713,000 reported for the 22-week 1943 period.

CONTRACTS

Continental U. S. Only
(Thousands of Dollars)

	Week Ending June 3 1943	May 25 1944	June 1 1944
Federal	$48,254	$15,742	$16,959
State & Municipal	4,296	6,278	3,344
Total public	$52,550	$22,020	$20,303
Total private	54,323	5,865	2,911
TOTAL	$106,873	$27,885	$23,214
Cumulative 1944 (22 weeks)			$757,233
Cumulative 1943 (22 weeks)			$1,598,632

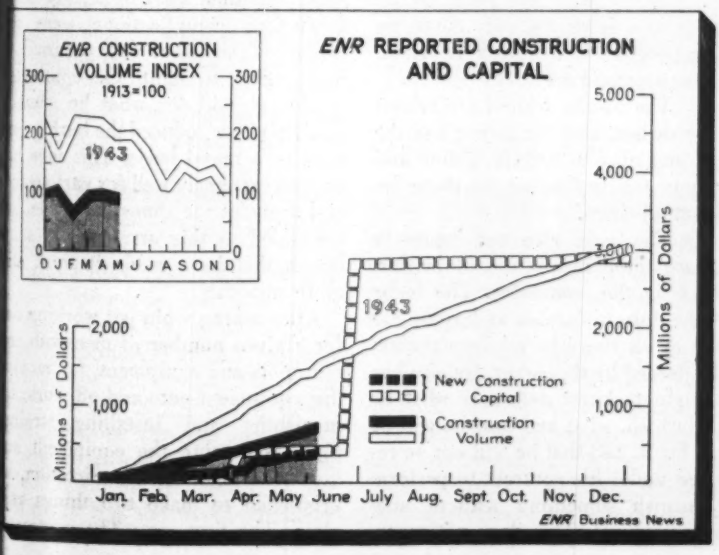
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

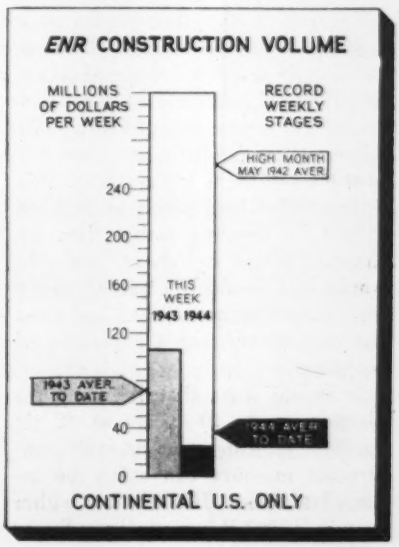
NEW PRODUCTIVE CAPITAL

	Cumulative 1943 22 Weeks	1944 22 Weeks
NON-FEDERAL	$92,363	$182,231
Corp. Securities	3,571	82,599
State & Mun.	76,659	45,852
RFC Loans	9,000	53,780
FPHA Loans	3,133	.....
FEDERAL	$400,350	$245,266
TOTAL CAPITAL	$492,713	$427,497

ENR INDEX NUMBERS

Index base=100		1913	1926
Construction Cost	June '44	298.72	143.59
Building Cost	June '44	235.33	127.21
Volume	May '44	100.	44.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1943
J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
Millions of Dollars
1943
New Construction Capital
Construction Volume
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Wind Pressure on Walls

Sir: Subsequent to my comments, *ENR*, Jan. 13, vol. p. 22, in reply to P. F. Campbell's inquiry, *ENR*, Nov. 18, 1943, p. 735, data has come to my attention which may bear on Mr. Campbell's suggestion that as brick and mortar are brittle materials and can take little deformation, perhaps Hooke's law may not apply. A leaflet, "Elasticity of Insulux Panel Under Repeated Air Tests" was issued Jan. 1, 1940, by the Owens-Illinois Glass Co., Toledo, Ohio, based upon tests in the Materials Testing Laboratory of Purdue University in 1938.

The air-bag pressure tests against the 7.25 x 8.67-ft. panel of glass blocks 8 x 4⅞ x 3⅞-in. thick showed complete elasticity, as demonstrated by straight line graphs for deflection plotted against pressure, for over 300 repeated loadings up to 40 lb. per sq.ft. The maximum deflections at the middle of the panel amounted to 0.015 in. for this pressure. Many more tests were conducted until permanent set and ultimate failure occurred. Permanent set occurred after 50 reversals of pressure at 60 lb. per sq. ft. and with a deflection at the center of about 0.032 in.

Complete failure of the panel occurred with failure of the adhesion of the mortar to the glass blocks at a pressure of 91 lb. per sq. ft. The mortar joints opened up along diagonal lines from the corners of the panel toward the center. At a pressure of 80 lb. per sq. in. the deflection amounted to at least 0.104 in. at the center. This action under load seems to indicate failure by bending rather than by shear. Failure by shear probably would have resulted in fracture along lines somewhat parallel to and near the supports around the outside of the panel.

It would seem that the complete elasticity up to 40 lb. per sq. ft. air pressure indicates that properly constructed masonry can safely be assumed to follow Hooke's law within certain limits. However, for ordinary brick masonry, Hooke's law would probably apply only up to a lower value than for glass blocks because the glass blocks tested had considerably stronger mortar joints than have those of ordinary brick masonry.

The wall action at the air pressures in this test would, of course, not be applicable to walls generally but instead varies with different dimensions of walls.

H. A. SWEET,
Engineer, Associated Factory Mutual Fire Insurance Cos., Boston, Mass.

Good Specs Can Be Written

Sir: Reference is made to the editorial in the Jan. 13, 1944, issue of *ENR* asking, "Are there no specification writers who think their specifications are good?" In 1942 the subsurface section and the legal adviser of the Department of Public Works wrote some specifications and I think they are good. So does the contractor.

They are specifications for test borings, but they illustrate the contract principle involved. They were written when it developed that difficulty would be met in collecting the information required for design of sewage treatment facilities scheduled by New York City for postwar construction. The principles involved are basic for all construction contracts, only the terms being peculiar to the work required.

The principles are:

(1) The results desired are known to the owner, and the owner has the right and duty to specify, define and promote the realization of these results at all times.

(2) The tools, men and means to produce these results are to be furnished by the contractor. The latter has the duty to furnish and apply the same at all times to produce the results needed by the owner. He also has the right to know definitely what he will furnish, what and how he will be paid for it, and that he will not be required under his contract to perform or furnish something without adequate payment. This does not mean, that the contractor will not assume usual financial construction risks.

Great care must be exercised by the writers of specifications and contracts and by those who administer them that the essential interests are not combined in such a way as to make it to the contractor's financial profit (even his financial necessity) to avoid furnishing what the owner wants. From lack of attention to this major point arises most specification complaints.

Since no complaints arose with the test boring contract, let us consider it in detail. Heretofore, boring work has almost universally been let by the footage drilled, some federal contracts being an exception. The interest of the owner in such a contract is primarily to determine conditions under the ground, and how they will affect design and construction. However, the need forced on the contractor is to produce the greatest footage at the lowest cost, while doing just enough information-gathering to avoid termination of the contract. The fault for bringing these two interests into direct conflict is, of course, that of the specifications writer.

In writing the boring contract we could not be more specific as to just what we wanted the contractor to do for each foot drilled. If we had known ground conditions in advance, we would have had the information required for design and preparation of construction contracts, and no borings would have been needed. There was available, however, another approach, that of paying in accordance with the quantity and class of work actually done by the contractor. Stated another way, no matter what subsurface complications were encountered, or what was required to bring them to light, the contractor would be paid for what he actually did. This view reduced the boring contract to a rental basis. This idea has worked extremely well for various federal agencies for almost a decade, but we added to this arrangement some things that have made it work still more smoothly.

After asking a bid per working day for a given number of men with certain tools and equipment, for moving this equipment onto and off work, for furnishing and installing strainer pipe, and using the equipment and men to drill under our direction, we proceeded to make two things very plain. The first was: The contractor

s to supply and maintain this equipnt as desired, and that he was to asme the reasonable risks of losing s or other equipment due to bad illing conditions, but that he would t be asked to abandon any part of work without being allowed a ped of time equal to that he would rmally spend on a footage contract attempting to retrieve the loss. The cond was: The city could determine the work progressed the informan wanted, and would assume comete control and direction of the conctor's crews to secure the desired sults. In other words, we put it ainly that if we did not like his iller and did not think he was getg what we need, we would tell the ntractor to get us another, which we uld expect him to do without quesn.

Under this type of contract we have ade some of the usual savings over e footage system that government encies cite in favor of the rental sis. These included the solution with ree borings of a proposal on which n times as much would unavoidly have been spent with a footage ntract.

In another case, a core barrel broke f in bad ground after a deep inined boring had progressed to a stance where several thousand dolrs of city funds were invested. Only steel-faced bit was on the barrel at e time. A day was the very most the ntractor would have wasted trying remove that barrel and continue the ole if he had been getting paid per ot of progress. The alternative would uld have been to abandon the borg, which would have required duplitting the amount already spent just reach the same depth, let alone to ach the lower depth we wished. owever, under the specifications, we ere able to get by the core barrel at fraction of what a fresh boring uld have cost, even though it took ree week's work with no footage rogress.

In still a third case, rock at a proosed building site was struck two et down in one boring, drilling was egun and produced much more than 0 percent of what looked like sound re. As the boring was an outside loation, a second run was made, and e core barrel was wedged by a rock ip and could not be budged by the ual tricks. Had the work been under footage contract the city could in no way have compelled the contractor to extract the bit and produce the lower core. We might have made him redrill the hole, but not dig and chisel out the core barrel, which was the only way in which it was possible to learn what sort of "sound" rock could slip and wedge a core barrel that tight.

It turned out that the rock at this point was seamed, and extensive decomposition had produced deep seams of material the ordinary inspector would call "dirt." Most of the rock between these seams was quite hard and cored well. A hole dug to extract this bit, however, showed that no footing excavation should be stopped at a level many feet below where we obtained "sound rock core." It also developed that another project near this site some years before resulted in a lawsuit and large "extras" because of this same condition, which was revealed by excavation but should have been known before drawing the contract.

When we proposed the type contract previously mentioned, we drew up the specifications and asked for help from drilling contractors in all parts of the country to make them workable. Most of contractors either violently opposed the idea or declined to bid. We were so plain spoken most contractors believed such a contract would prove a losing bargain. However, a year of work under the contract has proved that the plan of the city to look after its own interests and requirements, while specifying definitely what the contractor was to furnish, and just how much he was to receive for every unit furnished, worked out profitably for both parties.

HENRY D. HAMMOND,
Civil Engineer,
Dept. of Public Works, New York City

Credit for Character

SIR: Mr. Lucy and your magazine surely are entitled to congratulations on the admirable article, "Better Credit Protection on Construction," in the May 18th issue of *Engineering News-Record.*

What is said should be kept in mind constantly by all who have to do with construction contracts, when such contracts are under discussion and consideration. What is said about integrity and character being the cornerstone upon which to base credit is immutably true. It is, however, widely subordinated to qualification less dependable. Of course, you recall what the elder J. P. Morgan once said, "that he would rather lend a million dollars to a man with character and no security than to one with security and no character."

As I have mentioned to the author many times, there is a yawning gap in the construction credit situation, in that there is no source of credit for construction men with ability, experience and character, but who have no capital. I mean such men as superintendents and job managers who have come up through the ranks but have had no opportunity to accumulate sufficient capital to enable them to launch ventures of their own. The only way that many such men now have to accumulate capital is to be given a working interest by employers whom they have served loyally and competently for a long time. But, as you well know, such employers are few and far between.

I believe that this field is wide open for some sort of banker-surety company participation. Of course, there will inevitably be losses along with gains through the extension of such credit. But, I am willing to bet my last dollar that the balance will at all times be on the credit side of the ledger.

We have always had a great deal of talk and preachment with respect to integrity being the real cornerstone of credit. But talk and preachment is about all that is evident so far. The competent, experienced and honorable men who get credit based mostly on character are so few as to make this type of credit almost non-existent.

This is splendid contribution, I hope it will be fruitful. Faith, boldness and action are what is needed.

HARRY O. LOCHER,
National Assoc. of River & Harbor Contractors
New York, N. Y.

Error in Earthwork Article

Sir: In my article "Earthwork Computations By Use Of A Mechanical Calculator," *Engineering News-Record,* Feb. 10, 1944, vol. p. 197, the number in the next to the last paragraph should be —1,216, instead of —0766.

AZIEL LAFAVE,
c/o U. S. Coast & Geodetic Survey
Tappahannock, Va.

EDITORIALS

VOLUME 132 NUMBER 22

June 1, 1944

To Aid Mining and Logging

CONSTRUCTION EQUIPMENT is desperately needed for mining and logging. Prices offered for purchase or rental are all that the machines are worth, in some cases more than they are worth, yet only a few machines are available at any price. As a result, there is talk of requisitioning machines that are temporarily idle or on less essential work. One of the basic reasons for this situation is of course that contractors require a stock of diversified equipment, idle or soon to be freed, as an essential part of their bidding capital and, under present conditions, machines either sold or rented cannot be replaced with new at any price. Moreover, in selling, if maximum accounting deductions have been taken so that a machine is undervalued in the present market, much of the profit from a sale will be taken by the income tax. In the face of these difficulties perhaps a solution to the current shortage of machines is for the mining and logging interests to contract their jobs to construction companies. There would thus be made available not only the machines but the construction organizations that own them. Such an arrangement would also enable the construction contractors to keep their organizations together, and would make manpower available where it is needed. Here would seem to be a real opportunity for inter-industry cooperation.

Substantial Performance of Contracts

THE PENNSYLVANIA SUPREME COURT has restated the doctrine of substantial performance of contract, which Judge Cardozo at one time said "has been developed by the courts as an instrument of justice." The court's decision centered on a contract to excavate the cellar of a building, a contract that stipulated that the contractor was to be paid a higher rate for rock "which would require removal by blasting". When rock was encountered the contractor removed it with air hammers instead of by blasting, for fear of injury to adjoining buildings. The owner thereafter refused to pay the higher rate on the ground that the contract had stipulated blasting. When the contractor carried his claim to court, both the trial court and the superior court refused to give him redress. This obvious miscarriage of justice was corrected by the supreme court in a sharply worded decision. The contractor, it said, "should have long since been paid for his work... The equitable doctrine of substantial performance is intended for the protection and relief of those who have faithfully and honestly endeavored to perform their contracts in all material and substantial particulars." It is a good thing to have a court restate that fundamental principle for the benefit of those who like the judges in the lower Pennsylvania courts appear to be more concerned over the letter of the contract than with its spirit.

Recognition of Responsibilities

BEFORE the Senate Military Affairs Committee there is now a bill (S. 1901) calling for the appointment of a Sanitary Corps officer as an assistant Surgeon General of the Army with the rank of brigadier-general. This is a measure that should enlist the support of the entire engineering profession. It properly provides for greater recognition of the services being rendered in this war by a large group of sanitary engineers who form part and are under jurisdiction of the Medical Corps. No special privilege is sought by such recognition, since other professional groups in the Medical Corps, such as veterinarians, have the status now being asked for sanitary engineers. Resolutions already submitted by the American Society of Civil Engineers, the American Public Health Association and the National Society of Professional Engineers have endorsed the principles now incorporated in Senate Bill 1901. Every engineer who is interested in furthering recognition of the responsibilities of his profession owes it to himself to win support for this measure by writing to Senator G. L. Radcliffe, the sponsor, and to Maj. Gen. Norman T. Kirk, Surgeon-General of the Army.

Lumber's Usefulness Expanded

THE OLD ADAGE that necessity is the mother of invention is again exemplified in the account in this issue of how special paints and special methods for treating lumber were developed for military structures which had to be built under the wet conditions that prevail along the Alaskan seacoast most of the time. And as has happened so frequently in the past, the usefulness of these inventions has promise extending far beyond the emergency that brought them into being. Of those noted, the methods for treating

ber to check the swelling due to excessive ospheric moisture and to retard decay that elops rapidly under humid conditions would ear to be especially significant for peacetime lication. The war stimulated new interest in ber as a construction material and gave us new wledge of how to meet lumber's chief enemies, and decay. At the moment lumber is scarce due war demands, but after the war its field of useful- should be expanded as a result of what we have rned about it during war years.

w About Those New Horizons?

ST ONE YEAR HAS ELAPSED since this journal pub- ed a report, *New Horizons for Water Service*, ne 3, vol. p. 129), in which the status of such vice was analyzed and recommendations were de looking toward postwar improvements. The ation in regard to physical facilities, administra- , legal and financial policies was critically exam- d, and from this interpretation both a challenge d an opportunity emerged. The challenge was to ine objectives for the elimination of existing iciencies; the opportunity to prepare programs t might lead to the realization of these objec- es in the postwar period.

What have been the accomplishments in post- r water service planning during the past year a year in which millions of words have been writ- and spoken on the subject? So much "lip serv- " has been expended in this direction that the irman of the National Committee on Water and wage Works Development, Abel Wolman, wryly ncludes that postwar planning has degenerated o a national pastime. And although many unicipalities have gone through the motions of mpiling "lists" of projects, actually, the number cities, which have realistically embraced the portunity to prepare for the job ahead, is dis- pointingly small.

Even in that most obvious category of prepara- n—the blueprinting of plans and specifications r new projects—there is a woeful lag between the eds to be met and the determination of means to tivate their fulfillment. Yet, this is only one part the job to be done. Fundamentally important e the basic tasks of acquiring land and sites for ysical developments, executing legal and admin- rative matters and arranging for the financing of work. That little progress has been made is evidenced from a recent survey of 167 cities, showing that less than 3 percent of the funds had been made available to carry on their proposed postwar program of water and sewerage improvements. If this situation reflects the hope that the federal government will finance postwar construction, it has no basis in fact—either implied or stated by responsible federal authorities.

More likely, the lack of accomplishment in postwar waterworks planning may be attributed to a form of procrastination. In support of this assertion we need simply examine the situation in regard to meeting present and postwar operating and maintenance needs. No less an authority than the War Production Board views with alarm (see p. 99 of this issue) the failure of water utilities to keep their present facilities in the best possible shape now despite the availability of certain materials and equipment for this essential purpose. How illy-prepared, therefore, will water utilities be in their plans to undertake deferred maintenance programs when all restrictions on materials and equipment are removed?

All the discussion thus far has been related to lack of progress in activating programs for the correction of deficiencies in physical facilities. What about postwar plans for eliminating legal, fiscal and administrative handicaps to better water service? A dozen reforms, applicable to almost every water utility, clamor for attention; most notably there come to mind such matters as extension of service to suburban areas, labor-employer relationships, insulation of management from political influence, diversion of waterworks revenues for other municipal purposes, and revision of rate schedules. No waterworks administrator worthy of the name can be satisfied with his postwar planning until he has formulated policies to cope with these more subtle aspects of service improvement and since changes of this kind usually require many years of promotional effort before they can be effected, the time is none too early to initiate thinking on reform measures.

From this summary it may be concluded that we have made little progress in moving toward new horizons in water service, nor even gotten a clear focus on the direction of these horizons. How much longer can this evasion of responsibilities be overlooked?

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ENGINEERING ABROAD AS SEEN BY ENR EDITORS

A Job for "Skyhooks"

Harold W. Richardson
Western Editor, Engineering News-Record

Fig. 1. Reaching for the sky. Steep cable-operated incline railway built for access to an Alaskan defense project.

***Contents in Brief**—Many a construction man has longed for the mythical skyhooks when the going gets tough. Skyhooks would have been a blessing in building a series of coast defense stations in Alaska, but lacking them the contractor dug a toehold in a sheer rock face by drilling from a surveying barge, bulled his way up precipitous mountain slopes with tractors hitching themselves up by their own winches, built steep cable-operated railroads for transportation of men, materials and equipment, and built roads on 35 percent grades for final delivery of supplies. Concrete was pumped into place from modern mixing plants. In some cases sand had to be manufactured from rock.*

"BRING ON THE SKYHOOKS," is an old cry in the construction world. When a job is almost inaccessible, when it seems as if the very sky is the only means of supporting the equipment needed to build the project, then the call goes out for the mythical skyhooks. Wonderful as it may be, construction technique has yet failed to develop a means of grabbing onto the sky, but the contractor who built a series of coast defense stations along the rugged Alaska shoreline last year came mighty close to it.

Naturally, coast defense installations are located in positions that dominate the coastline, and in this case that meant the peaks and pinnacles of certain islands and peninsulas. Coast Artillery Corps officers selected the sites; the contractor and the army engineers in charge of construction had to figure out how to build the projects at the designated locations.

A modern coast defense station is quite an elaborate affair. First are the guns on heavy concrete foundations. Then there are ammunition storage depots, radio stations, control posts, housing for the troops, searchlights, water supply and power, and, of course, some means of access. Associated with each installation are two base-end stations—the "eyes" of the plotting and control room, located up to several miles away from the gun mount. These various facilities are usually scattered, which complicates the construction procedure, especially in rough terrain. Except for housing and minor buildings, the designs call for substantial concrete structures. This means lumber for forms, cement, aggregates, screening and crushing equipment, concrete-placing rigs, water for concrete, and all other materials and equipment must be transported to the precarious sites.

The most interesting, as well as difficult, job in this group of projects was the fortifying of two peaks on a wild, rough island. Access up the steep, timber-covered mountain slope was the critical problem here. The mountain rises precipitously out of the sea without a break at the shoreline that might provide a landing spot from which to attack the job.

Toehold blasted from cliff

Blasting out a toehold in the shoreline cliffs was the first step for the contractor. A barge loaded with port-

air compressors was shoved
st the rocky bluff. Then work-
standing on the barge gunwale
roped into place, bored holes in
ck face with hand-held drills for
irst round of dynamite shots.
the mythical skyhooks would
been a blessing, for Alaskan
rs are seldom quiet, and how
men ever drilled that rock from
ging, bucking barge is a mystery
, even themselves. After the first
was blasted out of the rock, the
ers went ashore and worked from
id base in enlarging the toehold.
all wharf was built out from the
ed ledge, and the first round in
uering the mountain was won.
location about 500 ft. above the
as the logical base for construc-
operations, although the slope
rd from the bay averaged 45 deg.
in some places was much steeper.
o small diesel bulldozers made
first assault against this steep
e. They literally bulled their way
hrough the trees, zigzagging back
forth in slashing out a switch-
trail. When the going got too
h, cables from the rear-end power
hes on the tractors were anchored
rees above, and by reeling in the
es the machines dragged them-
s backwards up the hill. Fuel oil
water had to be carried by hand
ervice the bulldozers.

Incline cableway main access

ext the contractor built a cable-
rated narrow-gage railroad from
wharf to the construction plant
Workmen clinging to the steep

Fig. 2. Motive power for the incline railway is a 50-ton mine hoist anchored to rock in the saddle of the mountain.

mountainside cleared out the right-of-way. Rail, ties and blocking for the low spots was partly dragged up the slope by cables from the bulldozers, partly carried and shoved by perspiring crews. Somehow the rails were strung out and bolted together, spiked to the ties and the track was shored up over the rough spots to form a crude, but usable, railroad. It was far from a smooth scenic incline such as those that grace Mr. Manitou and the Royal Gorge in Colorado; it was a rough, precarious stretch of track that undulated with the profile of the mountain.

A small gas-engine hoist was dragged to the top and operation of the world's dizziest incline got under way. The line car wasn't built with a level deck, but was simply a four-wheeled affair with its flat bed parallel with the track, open at the sides and fitted with an endboard on the downhill end to keep men and cargo alike from sliding off. Early operations with that small hoist were thrilling, to say the least. The hoisting mechanism was erratic and jerky; runaways and derailments were frequent. Yet, luckily casualties were limited to a few near heart failures.

3. Highway access to a couple of coast defense projects meant blasting a shelf out of rocky cliffs along the bay (left) building a precarious road on a 35-percent grade up the side of a mountain (right).

Before long the sputtering gas hoist was replaced by a 50-ton diesel power mine hoist and operations became much safer. A turntable was installed at the top and spur tracks were built to serve a cement storage and other warehouses. Air compressors and electric power plants were left at the bottom, and air pipelines and power cables were strung along the railroad.

There was room near the top of the incline for the big messhall, but barracks for the workmen had to be built into niches cut out of the higher slopes of the peaks. Then roads on grades as steep as 35 percent were built from the top of the incline to various parts of the job. One such road ended in a pitch so steep that a hoist had to be placed at the top to snake the trucks up that last stretch with a cable.

Sand manufactured from rock

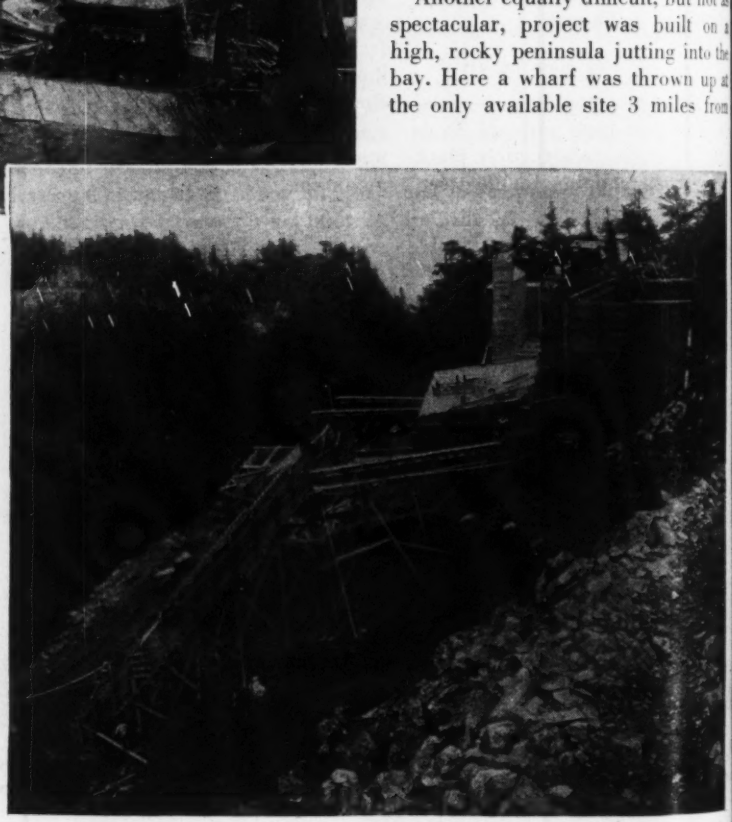
No sand or gravel for concrete could be found on the entire island. A rocky promontory on one of the peaks had to be blasted down for the gun mounts and the ammunition depot, so the spoil was converted into concrete aggregate. An elaborate crushing and screening plant, hung on the side of the mountain, crushed part of the rock down to coarse aggregate size, the remainder was pulverized into sand by roll crushers. While manufactured sand makes strong concrete, it results in a harsh, unwieldy mix that is hard to handle, adding to the construction difficulties.

Trucks hauled the finished aggregates from the crushing plant to small mixers set near each part of the project. Pumps distributed the mixed concrete from mixers to the forms—an incongruously modern note in an otherwise primitive construction job. Water for the mixers had to be hauled from the mainland in tank barges and pumped to the top of the mountain. Permanent water supply for the station involved building a small storage dam in a distant creek valley and laying a mile and a half of pipe over rough country.

One base-end station for this project occupies one of a group of rocky pinnacles rising abruptly out of the bay. A cable strung over the water between two rocky points serves as the track for a cableway system, the only means of access to the site.

Access difficult to another job

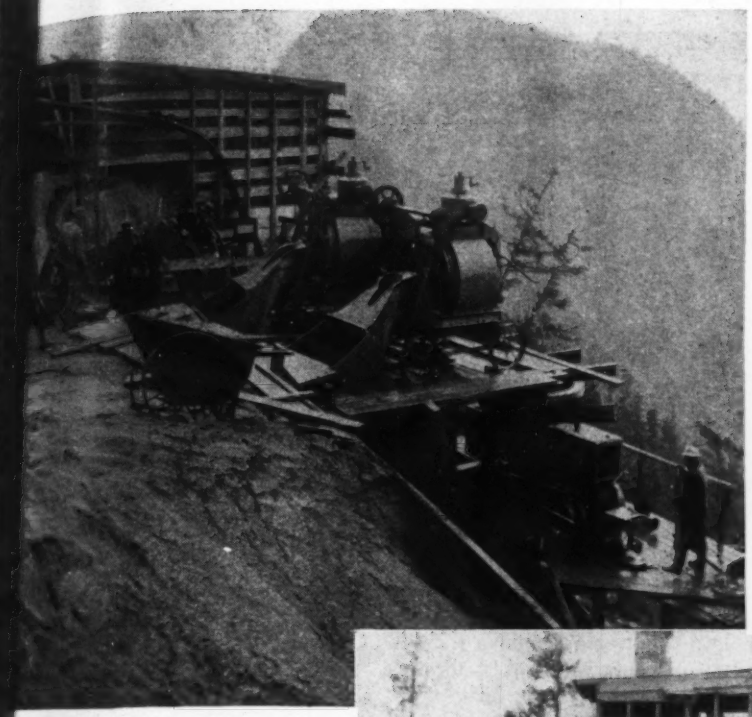
Another equally difficult, but not as spectacular, project was built on a high, rocky peninsula jutting into the bay. Here a wharf was thrown up at the only available site 3 miles from



SKY-TOP AGGREGATE DELIVERY AND PROCESSING

Fig. 4. So steep was the final pitch to one site (above) that aggregate trucks had to be snaked up the slope backwards by a gas hoist.

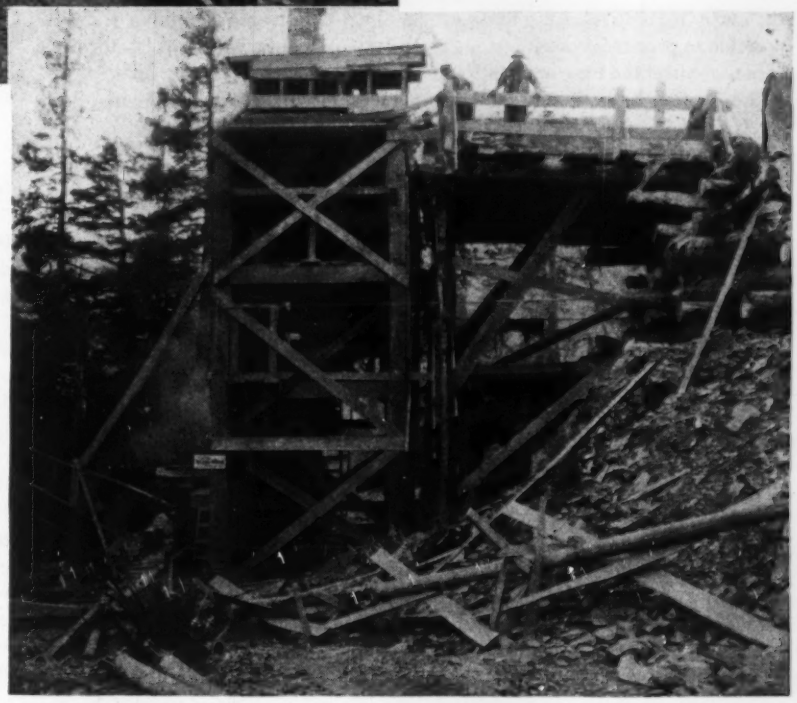
Fig. 5. All concrete aggregate for one job was processed from foundation excavation rock in this crushing and screening plant (right) sprawling over the side of the mountain.



SKY-TOP CONCRETE MIXING PLANTS

Fig. 6. Concrete mixing plants were hung on steep slopes. Left: two portable mixers feed a concrete pump.

Fig. 7. Below: Large batching and mixing plant and concrete pump serve one of the main installations.



main project, and a steep, wind- road was smashed through the gh terrain to the main station, and n was carried beyond to auxiliary ions by blasting a shelf out of solid k cliffs along the bay.

At the extreme far end of the proj- in a mountain wilderness, are two er installations. Concrete for their ndations was mixed at the end of road, then carried down a steep l to one of the jobs. To reach the er, high above the road, the con- ctor built a crude, but ingenious, lined railroad with wooden rails rying a home-made dump car. Con- te was transported in this car, led up the rough track by a cable m a chattering air hoist. Primitive it was, this crude incline served its rpose well.

Water supply a problem

To obtain water for construction, well as for permanent supply to the e, a small concrete dam had to be lt high in a creek valley. No road ld be built to the site. A small xer was shoved up the slope by nd, and sand, gravel and cement re carried from the road in buckets. dom has so much real sweat gone o building a small dam.

A screening and washing plant was up on the shoreline of a shallow cove for the preparation of concrete aggregates. Beach gravel was plentiful, but sand was scarce. The meager sand supply on the shore would be exhausted within a few days, then concrete operations would have to be shut down until a storm rolled in more sand.

At the main part of the project considerable rock excavation was necessary for the foundations. Considerable care was taken to disturb the skyline as little as possible, and to avoid making permanent scars, either in excavating or disposing of the spoil over the face of the cliff, so the station could not be recognized from the air. There is a lot of concrete in one of these jobs, so the contractor installed a large mixing plant, fed by trucks, and utilizing concrete pumps for distribution of the mixed concrete to the forms.

Prefabricated huts for troops

Housing for the permanent troops that will man the station consists of prefabricated huts well dispersed and

Fig. 8. Concrete delivery for one isolated installation was by a crude job-made cable incline powered by an air hoist.

camouflaged. Even the roads around the project are built with as little disturbance to natural surroundings as possible to minimize detection.

Cables connect the base end stations with the central base. Coast artillery soldiers laid most of the cable, and on land it was a hand labor job. About 100 soldiers would pick up a 1,250-ft. length of cable and walk it through the woods and over the hills.

West Construction Co., Seattle, built these difficult projects with Al Coker, general manager, in charge. Major Judson Wark was engineer in charge for the Army Engineers, representing Brig. Gen. Geo. J. Nold and Col. Chas. F. Baish from the Army headquarters.

Pennsylvania Supreme Court Upholds Contractors Claims

A decision of considerable importance to construction contractors was rendered by the Pennsylvania Supreme Court on March 20. It grew out of the attempt of the owner of a piece of property to avoid paying the contractor for rock removed in excavating the foundation on the ground that the contract said that $1.10 per cu.yd. would be paid for rock "which would require removal by blasting," whereas the rock was removed by the use of jackhammers. Jackhammers were used instead of dynamite because of the proximity of buildings that might be injured by blasting, and the actual cost to the contractor was considerably in excess of the cost of removing the rock by blasting. The contractor asked payment of $1.10 per cu. yd. of rock removed, which the owner refused to pay on the ground that it had not been removed by blasting, as required in the contract. Both the common pleas court and the superior court upheld the owner in his contention, as reported by Samuel I. Sacks in *ENR*, Nov. 18, 1943, p. 761. That finding was reversed by the supreme court in Sgarlat v. Griffith [349 Pa. 42 (1944)].

In reversing the lower court, Justice Drew said, "The lower court held tenaciously to the dictionary definition of the words 'require' and 'blasting' and held that those words were used in their ordinary and popular sense, and as so used in the contract made it appear that the parties thereto intended that any rock found in the excavation should be removed by the use of dynamite in blasting, and that the rock would not be removed in any other way. The superior court felt the same way about it.

"We must say we think this is a forced and strained construction of the contract. We are certain, at the time the contract was made, the architect, the general contractor and the subcontractor did not give any consideration to the method of removal of the rock and made it clear that appellee should only pay extra for the removal of that kind of rock which usually requires blasting. There is no doubt that the quick and cheap way to remove such rock is by blasting; and it must be admitted that this rock would have been removed in that way except for the danger incident to blasting in that place. Since appellee got full and complete performance of his contract, as is demonstrated by the certificate of the architect, he has no reasonable ground for complaint and he should have long since paid to the appellant the contract price for his work. Any other view would result in the forfeiture of appellant's labor and materials for what at most can only be regarded as a trivial or inappreciable variation in the contract. The law is not so harsh as to put such a penalty upon an innocent person for a minor defect which did not damage the other party or cause him to lose a cent.

"If this judgment stands, what becomes of the doctrine of substantial performance, which Judge Cordozo said 'has been developed by the courts as an instrument of justice'? This court has always turned its face against forfeiture. We said in Morgan v. Gamble, 230 Pa. 165, 79A. 410: 'The equitable doctrine of substantial performance is intended for the protection and relief of those who have faithfully and honestly endeavored to perform their contracts in all material and substantial particulars.'"

Gantry Used to Raise Bridge Approaches

***ents in Brief**—In changing the level of a long highway bridge that s the Tennessee River valley in the area to be flooded by Kentucky a high gantry crane was used to raise sections of the approach cts. The crane picked up 90-ft. sections of deck and held them while ork was set. Later, after the viaduct supports had been rebuilt by g about 25 ft. to the height of the towers, the crane lowered the sec- of the deck into final position.*

K RECENTLY CARRIED OUT to raise pproaches to the Tennessee River way bridge at Eggners Ferry, above pool level of TVA's Ken- Dam commands attention be- of the length of the deck raised unit, the method employed to ort the elevated deck sections un- ew tower bents could be con- ted, and the procedure followed ilding the new bents.

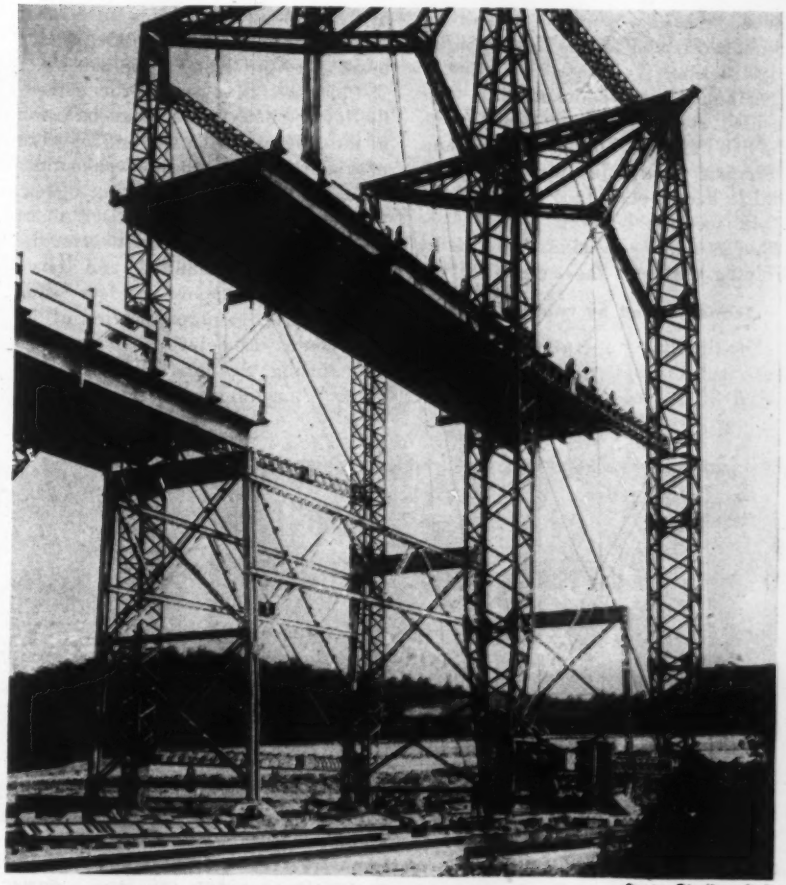
cated some 20 miles upstream the dam on State Route 68, the nal crossing was about three- ters of a mile long. Its main struc- consisted of six through-truss s varying in length from 151 to ft., an east approach was made up eventeen 45-ft. steel-beam, con- deck spans supported on steel rs, and a west approach consist- of 21 similar spans. These ap- ches were on a grade of 4 percent o the channel spans, which were except for the transition in the spans.

o elevate the approaches above imum pool level and to provide cient clearance for river traffic in main channel, most of the truss I-beam spans had to be raised. e of the piers supporting the es were strengthened and in- sed in height from 11 to 25 ft. greater portion of the bents sup- ing the viaduct spans were in- sed about 25 ft.

Trusses raised with jacks

wo hydraulic jacks under each floorbeam were used to raise the es, the piers being extended pe- ically as jacking continued. This edure resulted in no special prob- , and is similar to the method in raising the vertical lift rail- road bridge at Danville, Tenn., which was described in *Engineering News-Record* April 6, 1943, Vol. p. 486. An exception was the use of special auxiliary jacking girders located below the existing floorbeams for raising the 320-ft. and 366-ft. spans.

An electric-powered gantry crane of 200-tons lifting capacity was chosen to raise the approach spans. The gantry had a height of 80 ft. and a span of 48 ft. 9 in. It consisted of two portal frames, 50 ft. apart, joined by three lines of struts, one near the base, one at midheight and one at the top. An inverted kingpost truss at the top of each portal was pin-connected to the top of each leg and was knee-braced to one leg, an arrangement that avoided indeterminate stresses arising from any inequality in the elevation of the supports. The bottom of each leg was pin connected to a steel skid that was supported on two skid rails set 20 in. apart.



Sacta Studio photo

Fig. 1. By means of two 15-part fall lines, the gantry crane raised 90-ft. sections of deck (two spans) to permit supporting bents to be increased in height.

Engineers of the Tennessee Valley Authority had found the gantry economical in raising a highway bridge at Guntersville, Ala., (*ENR*, Dec. 7, 1939, p. 757). On the Guntersville project the deck was raised in one-span sections, swung through 90 deg., and lowered to the ground between the bents. The same procedure was considered for the job herein described, but was considered to be more expensive than raising two spans as a unit and supporting them on falsework while the new concrete bents were constructed.

Old bents utilized

Because of the scarcity of structural steel, maximum reuse of the old steel was necessary. The plan finally decided upon was to place the old tower bents on new reinforced concrete tower bents of sufficient height to bring the deck up to grade. Such a plan meant that the deck sections had to be supported on temporary falsework while the old bents were removed, the new bents built, and the old steel erected on the new concrete construction.

Although the expansion joints were located at every second panel point, the five lines of 27-in. steel floorbeams were not continuous for two spans, and so had to be spliced to permit the 90-ft. sections between joints to be lifted as a unit. Splicing was done by welding plates to the webs.

Section raised by two fall lines

For the lifting operation, two holes were cut through the concrete deck about 20 ft. from each end of each

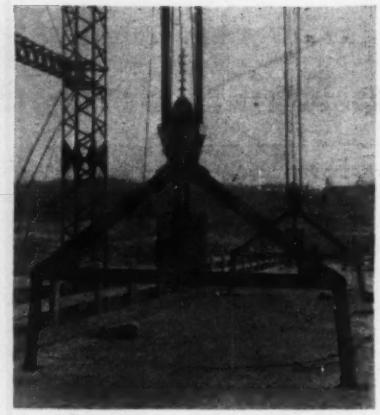


Fig. 2. The hitch to the needle beams below the deck was made through two holes cut in the floor at each beam.

two-span section of the deck to permit the legs of the lifting sling to be attached to needle beams below the roadway (Fig. 1). The needle beams were spaced so that the moment in the splices in the floorbeams was practically zero. Actual lifting was done by two 15-part fall lines suspended from the trussed tops of the gantry towers, power being supplied by a 25-hp. electric motor suspended from the lower horizontal strut at one side of the gantry. Automatic brakes were provided in case the power supply failed while a span was being raised.

After a span had been raised about 30 ft. above the old steel towers, the towers were dismantled and falsework built to support the deck while the reinforced concrete portion of the new bents was being constructed. In dismantling the old steel, only the rivets connecting the horizontal bracing to the columns were cut away, which permitted the two columns of each bent to be removed as a unit, thus expediting removal and reassembly of the old steel.

Two temporary falsework towers, each consisting of two 2-column steel bents was used under each 90-ft. length of the deck (Fig. 4). The 24-in. steel columns of these bents rest on 5x5-ft. spread footings. The four columns for a given tower were spaced as not to interfere with construction of the lower reinforced-concrete section of the new bents.

About an 8-hr. day was required to raise a section of the deck, remove the old steel, add the temporary falsework, and lower the section on to the falsework.

Bents built in three pours

The new reinforced-concrete towers bents rest on the footings of the old steel towers, the new concrete bents tied to the old foundations as illustrated by Fig. 5. Their tops were carried to an elevation sufficiently above pool level to protect the steel from wave action. In constructing the reinforced-concrete base of a typical tower bent, three pours were used. First, the four lower horizontal struts were poured, next the four columns and finally the four top struts. Generally, three days were required to complete the reinforced concrete work at each tower bent, four complete sets of steel forms being available to expedite this part of the construction.

A concrete of 2,500-psi. strength at 28 days was used. It was mixed by a 1-yd. mixer at a central plant, de-

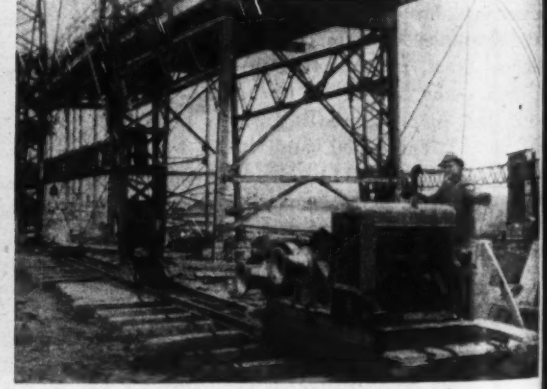
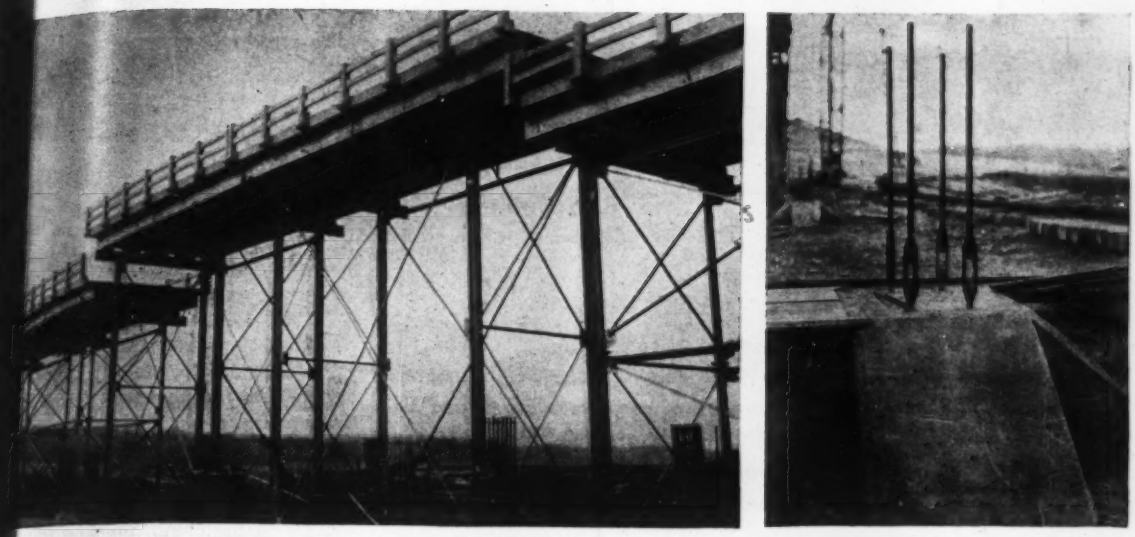


Fig. 3. Power for both lifting blocks of the gantry crane was provided by a 25-hp. electric motor (left) supported at side between legs of the crane and a short distance above rail level. Power for moving crane forward (right) supplied by a gasoline-powered, double-drum winch that slid along one pair of the crane rails. The winch also in erecting the needle beams below the bridge deck, removing and re-erecting the old steel.



4. Temporary support for the raised sections of deck (left) was provided by 4-column steel towers, two under each ft. section of the deck. These towers were so arranged as not to interfere with construction of the new concrete orts. The new concrete towers were built on the old tower footings (right), the new construction being tied to old foundations by four steel dowels threaded onto the anchor bolts for the old steel.

l by dump truck, and placed with y-down bucket handled by a crane h a 75-ft. boom. All concrete was rated in place.

When the concrete bent for a two- n section had been completed, the try crane backed up to that point supported the deck while the tem- ary falsework was removed and the steel tower was erected on the new struction. An exception to this thod was at those few spans where nges of grade required that the steel bents either be shortened or t the lower end of the bents be em- ded in the new concrete. The latter thod was followed, as it required work.

When the steel erection had been npleted, the gantry lowered the k in place. In sections where the de was changed, steel plates were ed under the floorbeams at the ports to accommodate the minor nges of slope at the bearings. nge of grade also required replace- nt of some of the handrails to e the handrail posts vertical, but erwise little work remained after deck sections were lowered in ce.

Power to move the gantry back and th along the bridge was provided a double-drum, gasoline-powered nch mounted on skids (Fig. 3). is winch also handled the needle ms used in lifting a section of the k and set the falsework steel with aid of a small crawler crane.

Because of the great length of the structure, the several phases of the work were carried out simultaneously, which permitted rapid progress. On the east approach, all work except reconstruction of the handrail was completed in 2½ months. During this time, operations continued 8 hr. per day six days of week. The contractor's crew number 140 men, a large proportion of these men working on the main crossing and the west approach.

All TVA bridge work is under the direction of C. E. Blee as chief engineer, George R. Rich, chief design engineer, K. C. Roberts, head structural engineer, and Everett Scroggie, senior structural engineer. Field engineering is supervised by E. M. Arnold, principal civil engineer, assisted by W. J. Starr and J. J. Helton.

The construction work involved in the raising of the Eggners Ferry bridge cost about $384,000. It was carried out under contract by the Rust Engineering Co., Pittsburgh, represented by E. P. Wilson, general superintendent.

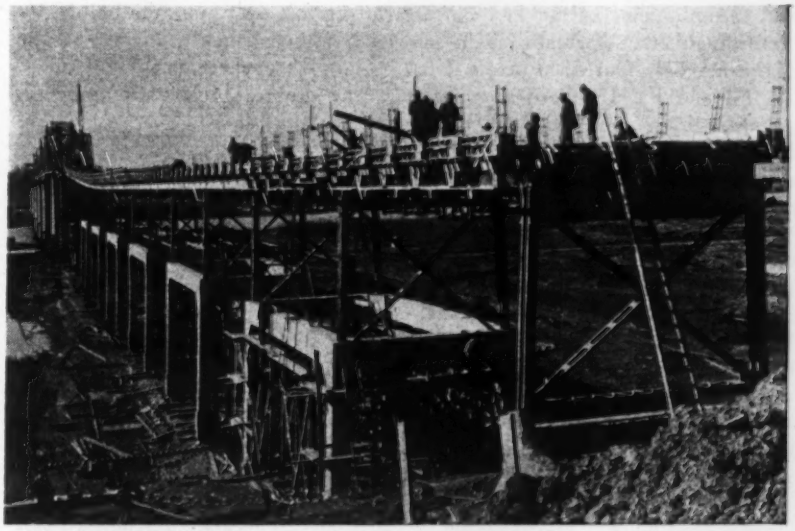


Fig. 5. Work of raising east approach nearing completion, erection of old steel on new concrete towers having been completed. Changes of grade of deck, which required addition of new handrails with vertical posts, were accommodated by embedding the lower portion of the old steel in the concrete.

Moment Distribution by Linked Rigidities

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***Contents in Brief**—Commencing with a simple model of linked bars, devised to facilitate visualization of the underlying relations, a simplified and speedy graphic method for the analysis of continuous beams and rigid frames is developed. The methods outlined in the article, "Graphic Methods for Engineers," are used. An equivalent numerical procedure is also developed. As compared with other methods, each joint is balanced once and only once.*

THE PROBLEM OF MULTIPLE-SPAN continuous beams (and equivalent rigid frames) may be illustrated by a simple mechanical model, as sketched in Fig. 1. The main bars, of any convenient lengths but with moment ordinates to scale, represent the closing lines in the respective members or spans. Their $\frac{1}{3}$-points near the intermediate joints are linked by connecting links V-U. Each link is provided with a fixed pivot point T, which is set to divide the link in the ratio of the rigidities of the members connected, as $r_1:r_2$. In addition, the terminal bars have fixed pivots at their outer $\frac{1}{3}$-points, U_1 and V_3, assuming fixed ends. (If the outer end is hinged, U_1 and V_1 represent the hinged end and the mid-point of the first bar.) Accordingly, the kinematic chain in Fig. 1 has only four fixed pivots, U_1, T_2, T_3, and V_3. (If there are more members or spans in the rigid chain, the kinematic model can be extended to correspond by simply adding the necessary additional bars and links.)

The vertical gap between the main members at each joint represents the unbalanced moment. Closing the gap represents the balancing of moments. The connecting links enforce proportional moment distribution. (The small correction for angularity is neglected. In an actual model, vertical guides and slotted holes may be used.)

For the initial condition—all joints rigidly fixed against rotation—the T pivots are clamped to prevent rotation of their connecting links.

To balance the moments at M_2, release the pivot clamp at T_2, while keeping T_3 clamped. By the proportionate division of the link $V_1\,U_2$, the two moment points at M_2 are forced to move in the ratio $r_1:r_2$. When these two moment points are brought together, the moments at M_2 are balanced. During this operation, with the bar M_2M_3 pivoting about V_2, the end at M_3 has moved up one-half as much as the end at M_2 has moved down (the moment carry-over). The dotted lines show the new positions.

Now clamp T_2, corresponding to holding the joint at M_2 against further rotation, and loosen the clamp at T_3 to permit the gap at M_3 to be closed. The T_3 linkage now forces the M_3 points to move in the ratio of $r_2:r_3$ in this balancing of moments. During this operation, the bar M_2M_3 has pivoted about U_2, and the gap at M_2 has therefore reopened.

Now clamp T_3, release T_2, and close the new gap at M_2. Then clamp T_2, release T_3, and close the new gap at M_3. Repeat this cycle of operations until both gaps are finally reduced to acceptable closure. If there are more joints in the chain, the cycle of operations covers the entire traverse in each successive repetition.

The foregoing is a kinematic analogue of the Hardy Cross method of moment distribution.

The method of "linked rigidities"

To eliminate the necessity of repeatedly going over the entire traverse of joints to reclose the reopened M-gaps, an alternative procedure may be illustrated by the same kinematic model (Fig. 1).

Starting with the first joint, loosen T_2 and close the gap M_2. Lock the points at M_2 together (as by a pin connection) so that they cannot separate again. *Leave T_2 loose* for the remainder of the operation. Now loosen T_3, and close the gap at M_3. The operation is completed. If there are more joints in the chain, the first traverse completes the operation.

Obviously, with T_2 left loose and with the M_2 points pinned together, the motions of the various points will not be the same as when T_2 is clamped and the M_2 gap is allowed to reopen. Instead of the M_3 points moving toward each other in the ratio of $r_2:r_3$, the two points at M_3 will now move together in a modified ratio, $r_{1,2}:r_3$. The two spans of rigidity r_1 and r_2 are now linked together, and the *linked rigidity* $r_{1,2}$ determines the change in M_3 produced by any subsequent rotation of the joint at M_3.

The graphic or numerical counterpart of the foregoing procedure consists in distributing the unbalanced moments, at the successive joints, in the ratios $r_1:r_2$, $r_{1,2}:r_3$, $r_{1,2,3}:r_4$, ..., in which $r_{1,2}$ is the linked rigidity of the first two spans, $r_{1,2,3}$ is the linked rigidity of the first three spans, etc. For convenience, the operation is preferably carried out from both outer ends toward any selected intermediate joint or span.

When T_2 was left loose, but with the moment points pinned together at M_2, the linked closing lines in the first two spans were left free to move under the sole constraint of the two points U_1 and T_2 acting as fixed pivots. Kinematically, this is equivalent to a virtual center of rotation in the bar M_2M_3 at some point J, located on a line drawn through the actual pivots U_1 and T_2. Any position of the closing line after the M_2 gap is closed will pass through J. The point J thus becomes a *fixed point* in the closing line. A pivot pin inserted at J, after the M_2 gap is closed, could be substituted for the pivot T_2 and its link V_1U_2, with-

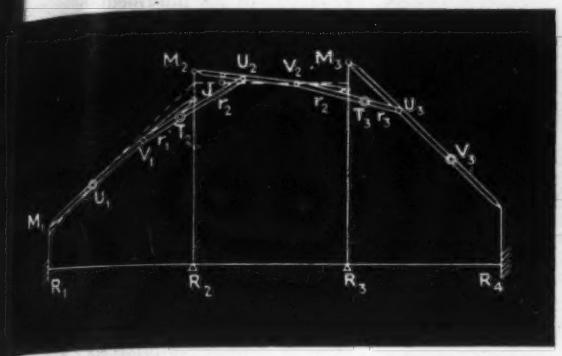


Fig. 1. Kinematic model for moments in continuous beams and rigid frames.

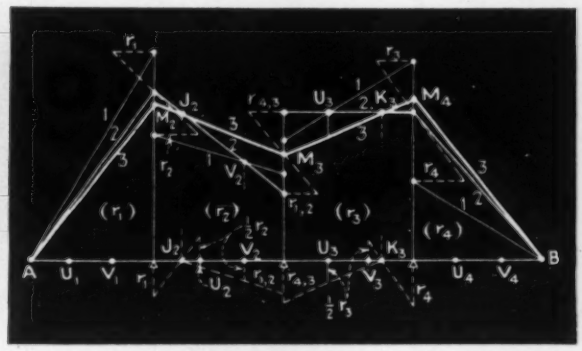


Fig. 2. Graphic solution of four-span continuous beam or frame by the method of linked rigidities.

ut altering any subsequent motions f the kinematic chain. Similarly, ith T_2 loose, a pin at J could replace pin at M_2 in keeping the M_2 gap osed. Use of the fixed point J thus reserves linkage once established, nd is therefore equivalent to applyg the concept of linked rigidities.

In this method of linked rigidities, e moment carry-over toward the left each span, or rotation of the closing ne, is determined by the J-point inead of the U-point. In carrying oment changes toward the right end f the chain, the corresponding fixed oint near the right end of a span is lled the K-point.

The linked rigidities $r_{1,2}$, $r_{1,2,3}$, . and the J and K points may be und by either simple graphic or umerical procedures. Because the xed points J and K may be used, in hole or in part, to replace the linked gidities in the graphic operation, is solution of the problem may also described as a Method of Fixed oints.

Application of linked rigidities

In Fig. 2, the lines *1-1* are the inal closing lines for fixed-end moents. Proceeding from each outer d, the moments are balanced aphically as shown, in the proporn of the rigidities $r_1:r_2$ at the secd joint and $r_3:r_4$ at the fourth joint; e closing lines *2-2* are thus obtained. r the first and second spans linked gether, and for the fourth and third ans linked together. These closing es must pass through V_2 and U_3, cause the joint at M_3 is still reded as fixed. Now release the joint M_3 and balance the moments at t point in the ratio of the *linked* gidities $r_{1,2}$ and $r_{4,3}$. This gives the al closing line *3-3*, which is drawn from M_3 through the left fixed points J in the spans to the left and through the right fixed points K in the spans to the right. This completes the solution.

The graphic determination of the J and K points and of the linked rigidities is indicated on the base line, as derived below. Any convenient lengths proportional to the respective values of r may be used, noting that the values of r represent I/l (or $\frac{3}{4}\,I/l$ in members hinged at the outer end). Note also that the spans may be drawn to any arbitrary lengths, not to scale; their $\frac{1}{3}$ points give U and V. In Fig. 2, the outer members are shown hinged; if the ends are fixed, the closing lines pass through the initial outer U and V points, respectively.

The fixed points J and K on the closing lines are also known as "conjugate points," and the U and V points as "characteristic points."

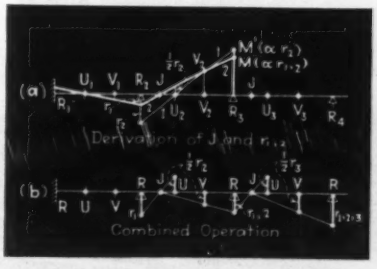


Fig. 3. Derivation of linked rigidities and fixed points for moment distribution in continuous beams and rigid frames.

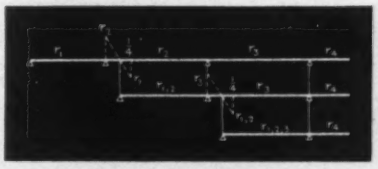


Fig. 4. Alternative graphic procedure for obtaining linked rigidities.

Graphic derivations

In Fig. 3a, a moment M' applied at the right end of Span 2 produces the moment line *1-1*, which passes through U_2 if the joint at R_2 is held fixed. Upon releasing the joint at R_2 and balancing the moments at that point in the ratio of $r_1:r_2$, the moment line swings to the position 2-2, passing through V_2 since the joint at R_3 is held fixed during this adjustment. The end-moment M' is thus reduced to M. M' is the moment acting against the single-span rigidity r_2; M is the moment acting against the linked rigidity of the two spans, $r_{1,2}$. Since they produce equal end rotations, represented by the height of V_2, the two moments must be proportional to the respective rigidities. Their ratio $M:M'$ therefore gives the desired ratio of $r_{1,2}:r_2$. Moreover the intersection of line *2-2* with the base line locates the fixed point J on the base line, representing the point of zero moment from moment changes to the right.

Abstracted from Fig. 3a, the simple geometrical relations locating the J points and determining the successive linked rigidities are combined in a single chain operation in Fig. 3b. The same procedure starting from the right end of the structure gives the K points and the successive linked rigidities in the spans from the right, both chains meeting at some intermediate joint or span.

Other constructions, satisfying the same geometric relations and independent of the fixed points, may be used for obtaining the linked rigidities, as illustrated in Fig. 4. In confronting spans, moments, or closing lines to the right, the first two spans

may be replaced by $r_{1,\,2}$, the first three spans by $r_{1,\,2,\,3}$, etc.

Directly reproducing and utilizing the kinematic relation developed in Fig. 1, a novel and useful graphic method of locating the fixed points in the members of a three-element rigid frame, with columns either vertical or inclined, is shown in Fig. 5. The *V-U* links are drawn and the *T* points are marked to divide these links in the ratios $r_1 : r_2$ and $r_2 : r_3$. The *UT* and *VT* lines then locate the required fixed points, *J* and *K*. The frame need not be drawn to scale, nor to correct angles, since merely the fractional positions of the fixed points are required.

An expedited graphic method

The graphic solution is easily streamlined. Instead of carrying the linkage all the way to an intermediate joint, as in Fig. 2, the two joints adjacent to a selected intermediate span may be balanced simultaneously to obtain the final closing line. Although drawn for a three-span continuous beam, Fig. 6 shows the graphic solution for final moment closure at any intermediate span or member of any continuous beam or rigid frame of any number of spans, with any loadings in any or all spans.

In Fig. 6, M''_2 and M''_3 are the fixed-end moments in the span, and M'_2 and M'_3 are the fixed-end moments from the (linked) spans or members to the left and right, respectively. Since U_2 is a pivot point for the initial closing line in the span, $U_2\,M'_2$ is a possible final closing line consistent with the loads and rigidities of the spans and members to the left of R_3. Consequently the line $U_2\,M'_2$ must contain the fixed point J_2, and J_2 is thus determined by using the J_2 vertical predetermined on the base line. The right fixed point K_2 is similarly obtained. A line through the two fixed points is the final closing line; it is extended through the *J* and *K* points of the (linked) closing lines in the spans to the left and right, respectively, thus completing the solution.

Note that the linked rigidities of the middle span are not required; hence, for a three-member structure, no linked rigidities are needed. Note also that the fractional locations of the fixed points along the spans depend only on the relative rigidities, but the heights of the fixed points depend upon the loading.

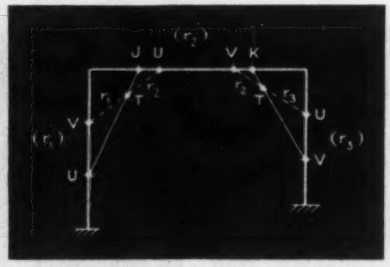


Fig. 5. Three-member rigid frame. Graphic location of fixed points.

Fig. 6 establishes and applies a useful general principle, permitting expedited graphic solutions:

> Independent of the loading and rigidities of the spans and members to the right, the left fixed point *J* in any span will always be located on the line *M'U*, where *M'* is the fixed-end moment from the linked spans to the left and *U* is the left ⅓-point of the fixed-end moment line in the span. Similarly, independent of the loading and rigidities of the spans and members to the left, the right fixed point *K* will always be located on the corresponding line *M'V* at the right end of the span.

In Fig. 7a, the expedited graphic solution derived above is applied to a five-span continuous beam. The four fixed points are located on the base line (as in Fig. 3b) and are then projected up to the four loci ($M'_2\,U_2$, $M'_3\,U_3$, $M'_4\,V_3$, and $M'_5\,V_4$) to obtain the four fixed points (or "conjugate points") through which the required closing line is drawn. This completes the solution.

The same graphic solution, with obvious minor modifications, may be used for an equivalent three-bay rigid frame, Fig. 7b. Note that the rigidities r_b and r_c of the intermediate columns are added to the linked rigidities $r_{1,\,2}$ and $r_{5,\,4}$ before locating J_2 and K_3 in the middle span.

A two-story rigid frame may also be solved by adaptation of Fig. 7a. The successive fixed points and linked rigidities around the frame are easily obtained by the chain construction of Fig. 3b. The clockwise circuit is commenced at a trial location of one of the *J* points, which is automatically corrected at the completion of the circuit. A similar counterclockwise circuit locates the *K* points.

Graphic method for side-sway

In Fig. 8, line *1-1* is the initial (fixed-end) closing line for unsymmetrical loading, and line *2-2*, passing through the fixed points *J* and *K*, is the balanced closing line if side-sway is prevented. The fixed points on the base line are located, as in Fig. 5, by drawing the lines *AJ* and *DK* through the rigidity division points *T*. Upon extending the same two lines *AJ* and *DK*, their intersection locates *N*, the node point or zero point for side-sway moments. (This short-cut for locating *N* may be derived kinematically, by considering *AJ* and *DK* as pivoted links defining the rotational shift of the moment line under side-sway; the intersection of the two links gives the virtual center *N*, vertically above the point of zero moment change. Alternative proof: *AJN* and *DKN* are closing lines for M_c and M_b, respectively; at their intersection *N*, the two closing lines cancel to produce zero moment.)

If the columns are of equal height, the rotated closing line *3-3* will be

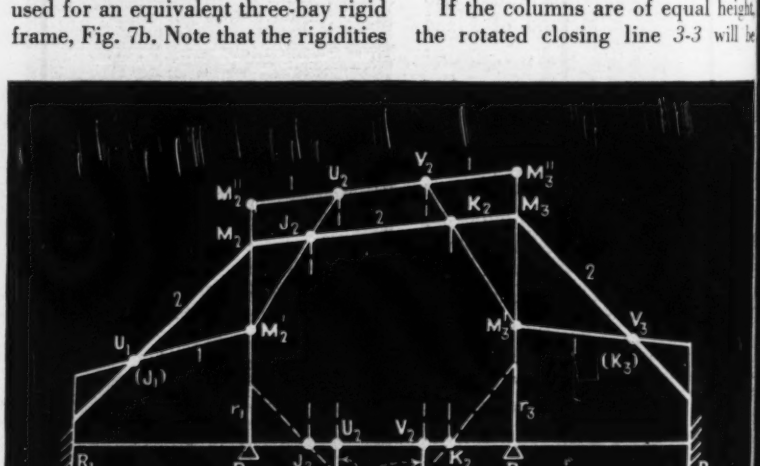


Fig. 6. Graphic method for final moment closure at an intermediate span.

orizontal. If the columns are of un-ual height, the rotated closing line drawn through P, given by the line D. This simple construction satisfies e condition that the end moments M_1 and M_2 must be in the ratio $h_1:h_3$ r equal and opposite shears in the o columns.

In a three-member bent with col-mns fixed at the base, Fig. 9, the ree required node points N_1, N_2 and N_3 may be expeditiously located by n extension of the direct graphic ethod used in Fig. 8 and based on e same kinematic relations. Each N oint is simply located by the inter-ection of two lines, one drawn hrough the two preceding J points nd the other through the two fol-owing K points. If the columns are of nequal height, J_0 will be on the orizontal through A, and K_0 will be n the horizontal through D. In a igid frame forming a closed quadri-lateral, the four node points are simi-arly located, using J_4 and K_4 within he fourth member; the vertices of he resulting four-pointed star, pro-ected upon the respective members, ive the four node points.

For the general case of an unsym-metrical bent with columns fixed at he base, the new streamlined solution utilizing the N points of Fig. 9) is hown in Fig. 10. To apply side-sway orrection, the balanced closing line *1-1* is simply rotated to a line *2-2* assing through P', given by N_1N_3P nd BC. The new closing line *2-2* will hen have equal and opposite slopes n the side members, representing alanced horizontal shears.

In Fig. 11, the lines N_1-N_2-N_3 rawn across the bent are the lines of he external reactions for any hori-ontal side-sway load H applied at B. he triangle constructed on these lines the force polygon, giving directly e relative values of H, H_1, H_2, and . For any horizontal shear H across e bent, the additional reactions and oments are given by Fig. 11.

In the foregoing solutions, Figs. 8 11, the usual computations for ap-ortionment of shears and moments the two columns are eliminated. In merical methods for side-sway and r transverse shear, corresponding ort-cuts may be devised and applied.

Numerical application of method

The procedure that follows, al-hough derived independently, is ound necessarily to involve basic

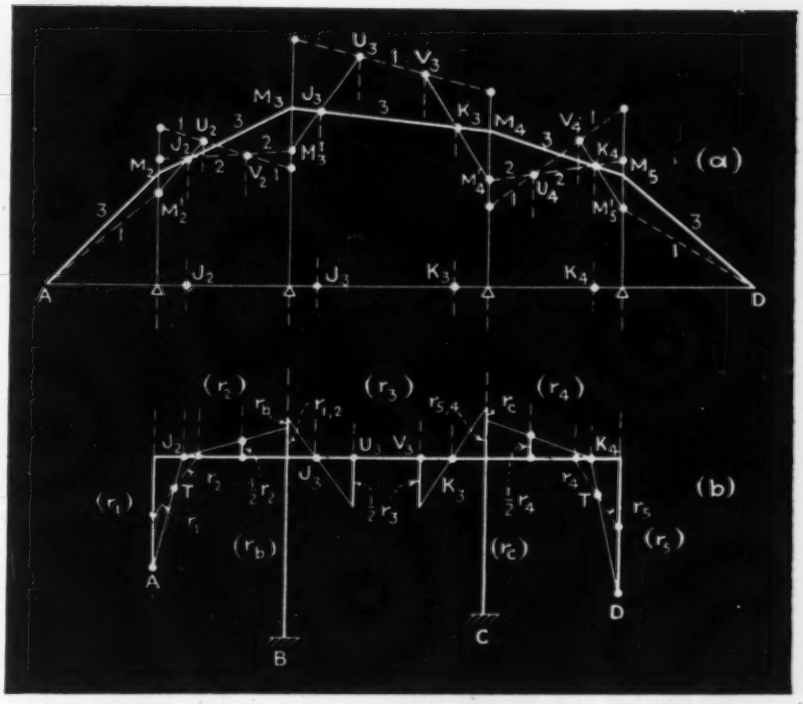


Fig. 7. Graphic analysis by linked rigidities or fixed points. (a) Application to five-span continuous beam. (b) Rigid frame equivalent to the five-span continuous beam.

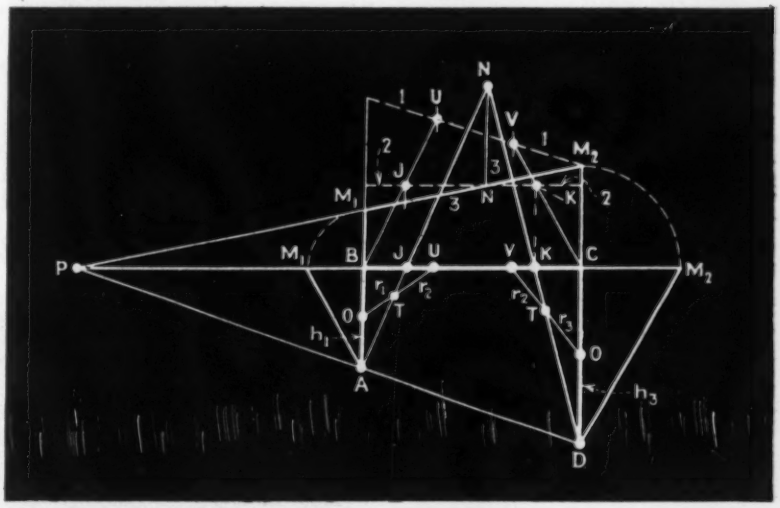


Fig. 8. Complete graphic solution of an unsymmetrical bent including side-sway correction.

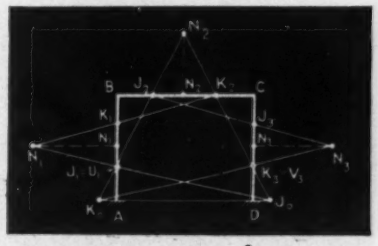


Fig. 9. Direct graphic method for locating the node points for side sway or horizontal shear in a rigid frame.

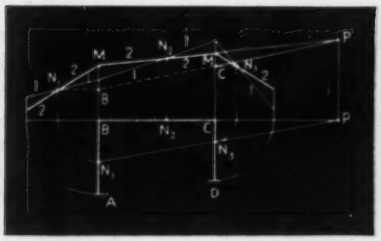


Fig. 10. Graphic method for side-sway correction in an unsymmetrical bent with columns fixed at the base.

features and concepts in common with various solutions previously published, including particularly the "direct method"—also called the "precise method"—developed by Lin, Wise, and others. The new feature of the writer's method is that of *progressive* linkage, as distinguished from the simultaneous advance linkage hitherto proposed. In either form, unlike the Cross method of successive approximations, each joint is balanced once and only once. While retaining this advantage of the "direct method," preliminary calculations are minimized and maximum brevity is attained in the actual moment distribution by the new departure:

> Each joint is treated as fixed until it is reached; it thereafter remains permanently linked by the moment balance.

The procedure is the exact numerical counterpart of Fig. 2 in the graphic method, utilizing the same concepts and following the identical sequence of operations. Working from both ends toward a selected intermediate joint, the joints are progressively balanced and linked until final closure is made at the last remaining joint.

Past objection to "direct method"

The chief obstacle to the adoption of the "direct method" in the past has been the thought that the computation of the linkage constants might outweigh the saving of work in the subsequent moment distribution. With the method devised by the writer, the actual moment distribution is further abbreviated, and the preliminary calculations are cut to one-half or less. Since the linkage is progressive, toward the center, only one-way linkage needs to be figured. In a four-span beam, the number of linked constants required is reduced from 12 to 4; and, in a five-member chain, the number is reduced from 16 to 6.

The numerical counterpart of the "fixed points" or "conjugate points" of the graphic method is the carry over factor c. The carry-over toward a fixed joint—and each intermediate joint is treated as fixed until it is balanced—is always $\frac{1}{2}$, corresponding to a pivot point (U or V) at $\frac{1}{3}$ of the span.

Since J and K are always limited to the outer thirds of the span, the value of c will always be between zero and $\frac{1}{2}$, the two limits corresponding to zero restraint (hinged end) and infinite restraint (fixed-end), respectively.

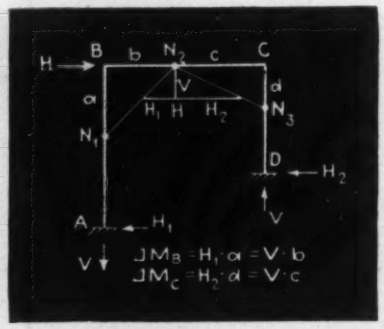


Fig. 11. Use of node points for graphic analysis of horizontal shear in an unsymmetrical bent.

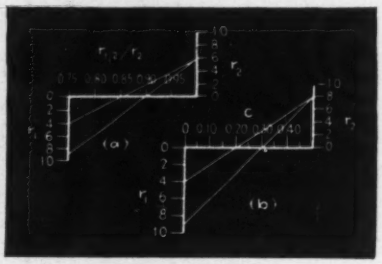


Fig. 12. Nomographs giving linkage factors. (a) Linked-rigidity factor $r_{1,2}/r_2$. (b) Carry-over factor, c.

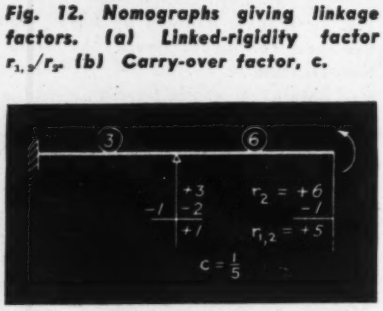


Fig. 13. Linkage constants obtained by simple moment distribution.

By the geometry of Figs. 3 and 4, convenient formulas for linked rigidity and for the corresponding carry-over factor may be written:

$$r_{1,2} = \frac{4\frac{r_1}{r_2} + 3}{4\frac{r_1}{r_2} + 4} r_2 \qquad (1)$$

$$c = \frac{2\frac{r_1}{r_2}}{4\frac{r_1}{r_2} + 3} \qquad (2)$$

If the member of rigidity r_2 is linked to two or more members at the common joint, r_1 denotes the sum of the rigidities (or linked rigidities) of those members.

Note that the magnitude of the linked rigidity $r_{1,2}$ is always between $\frac{3}{4}\,r_2$ and r_2, the two limits corresponding respectively to zero restraint and fixed restraint at the joint.

Instead of evaluating $r_{1,2}$ and c independently, either may be computed from the other:

$$r_{1,2} = \frac{3}{4 - 2c} r_2 \qquad (3)$$

$$c = 2 - \frac{3}{2}\frac{r_2}{r_{1,2}} \qquad (4)$$

The foregoing formulas have been designed and tested for ease and speed of mental or slide-rule calculation. They may be written in various alternative forms to suit individual preferences or computing habits.

Graphs are easily devised giving directly the values of $r_{1,2}$ and c for any pairs of values of r_1 and r_2. A simple and instructive form of nomograph, easily remembered and quickly reproduced, is presented in Fig. 12. A line or straight-edge joining a pair of values of r_1 and r_2 cuts the horizontal base at the linkage factor. (In Fig. 12b, r_1 is laid off to 4/3 the scale of r_2.) The two nomographs may be combined by transposing the c-scale to Fig. 12a.

The linkage constants may also be written almost directly, without the use of formulas. Fig. 13 is a simple numerical reproduction of the graphic derivation in Fig. 3a. Upon applying an end moment equal to r_2 and then

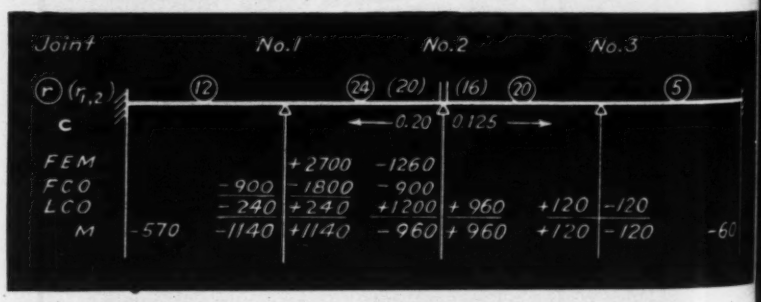


Fig. 14. Four-member chain with fixed ends. Moment distribution by linked rigidities.

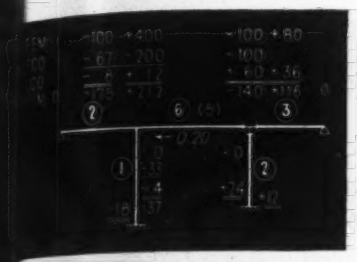


Fig. 15. Five-member rigid frame with three-spans loaded. Moment distribution by linked rigidities.

leasing (balancing) the joint to be nked, the reduced end moment is $_{1,2}$ and the ratio of end moments is c. The complete procedure of the ethod of linked rigidities may be riefly stated:

1. Working from both ends toard a selected intermediate joint, lance the end moments at each int in succession, using the ordinary nlinked) rigidities and carry-overs r all members not previously linked. ter a member is linked by the balcing of the joint behind it, its linked gidity is used in balancing the joint ead of it.

2. After the joint selected for final sure is balanced, the added moents are carried back to the ends of structure, using the linked carry-r factors.

Numerical examples

In Example 1, Fig. 14, (a four-span ntinuous beam or any equivalent id frame), only two linked rigidities are required. For the first and second spans, with $r_1 = 12$ and $r_2 = 24$, $r_{1,2} = 5/6\ r_2 = 20$, and $c = 1/5$. For the fourth and third spans, with $r_4 = 5$ and $r_3 = 20$, $r_{4,3} = 4/5\ r_3 = 16$, and $c = \frac{1}{8}$. In the first line, the given fixed-end moments are written, using any preferred convention of signs. In the second line, the moment at Joint 1 is distributed in the usual manner, using the unlinked rigidities 12 and 24, and the unlinked carry-over factor $\frac{1}{2}$. (Any moments at Joint 3 would be similarly balanced and distributed in the same line.) In the third line, the moments at the middle Joint 2 are balanced, using for the first and only time the *linked* rigidities 20 and 16. In the same line (marked L.C.O. or linked carry-over), the added moments at the middle joint are carried outward, using the linked carry-over factors $c = 1/5$ and $c = \frac{1}{8}$.

The procedure is compact, systematic; and the results are exact. The reader is invited to make his own comparisons of relative brevity.

If all spans are loaded, the only difference is that the blank spaces are filled in. Unlike the procedures developed by Strassner and others, the work is not multiplied by the number of spans loaded.

In Example 2, as indicated in Fig. 15, the second joint is selected for final closure. The given moments are balanced at the first joint, in the proportion of the unlinked rigidities 2:6:1, and $\frac{1}{2}$ the added moment is carried over to the next joint. There

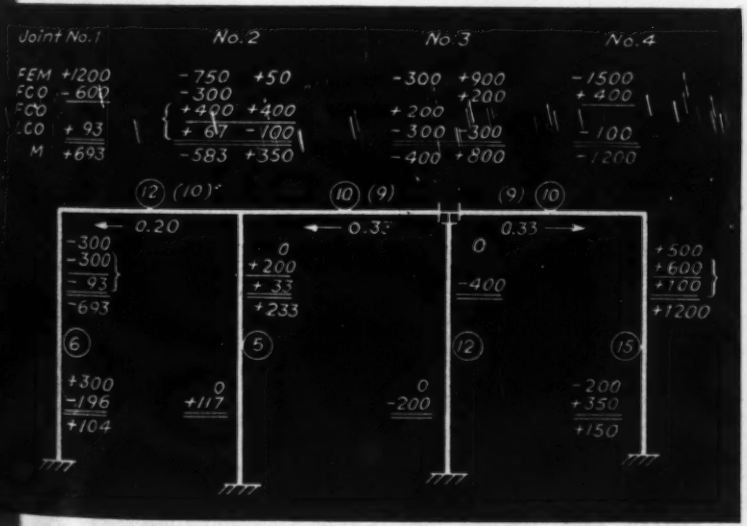


Fig. 16. Three-bay rigid frame with end columns and all spans loaded. Moment distribution by linked rigidities.

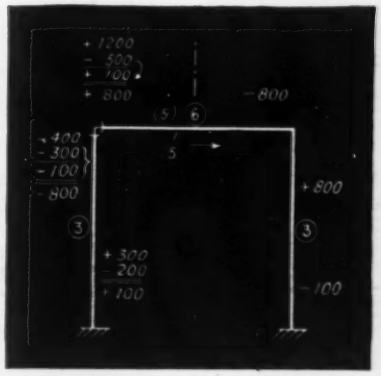


Fig. 17. Symmetrical bent symmetrically loaded. Abridged solution by linked rigidities.

the moments are balanced in the proportion of (5):3:2, where (5) is the linked rigidity $r_{1,2}$ for $r_1 = 1 + 2$, and $r_2 = 6$. The corresponding linked carry-over factor is 0.20, hence 1/5 of the added moment at the second joint is carried back to the first; there it is distributed in the ratio of the rigidities 2:1 to the two preceding members.

The rigid frame in Example 3, Fig. 16, is ten-fold statically indeterminate. The unbalanced moments at Joint 1 are distributed in the ratio 6:12, those at Joint 2 in the ratio (10):10:5, and those at Joint 4 in the ratio 15:10; and in each case $\frac{1}{2}$ the added moments are carried over to the adjoining fixed ends, noting that joints ahead are treated as fixed until they are linked by moment balance. Final closure is made at Joint 3, using the rigidity ratio (9):(9):12, since $r_{1,2,3} = 9$ and $r_{5,4} = 9$, and the column is unlinked. The moments added in this final balance and those not previously carried back are now carried back to the two ends, using the linked carry-over factors 1/3 and 1/5 toward the left, and 1/3 toward the right.

The foregoing method may be applied to multi-story frames and to side-sway problems. Space-limitation prevents inclusion of numerical examples.

The method of linked rigidities is easily adapted to the case of haunched beams or to the general case of members of variable I. Using the method of Fig. 13, the general formulas for the linkage constants are directly written:

$$\frac{r_{1,2}}{r_2} = \frac{r_1 + r_2\,(1 - C_L\,C_R)}{r_1 + r_2} \qquad (5)$$

$$c = \frac{C_L\,r_1}{r_1 + r_2\,(1 - C_L\,C_R)} \qquad (6)$$

where C_L and C_R are the left and right carry-over factors of the unlinked member (r_2) of variable I. Various tables and graphs for r_2, C_L and C_R are available. With $r_{1,2}$ and c precalculated by Eqs. (5) and (6), instead of (1) and (2), the moment distribution proceeds exactly as for members of constant section. (Upon substituting $C_L = C_R = \frac{1}{2}$, Eqs. 5 and 6 reduce to the formulas previously given.)

In special cases offering short-cuts, the method of linked rigidities retains its relative advantages. The abridged solution for a bent with symmetrical rigidities and symmetric[al] F.E.M. is illustrated in Example 4, Fig. 17. A single moment balance does the trick. The carry-over is simply reflected back, instead of crossing the center-line. The solution is therefore seemingly reduced to an irreducible minimum.

Improved Signal Lamp Designed For Night Surveying

Douglas L. Parkhurst
Chief, Instrument Division, U. S. Coast and Geodetic Survey, Washington, D. C.

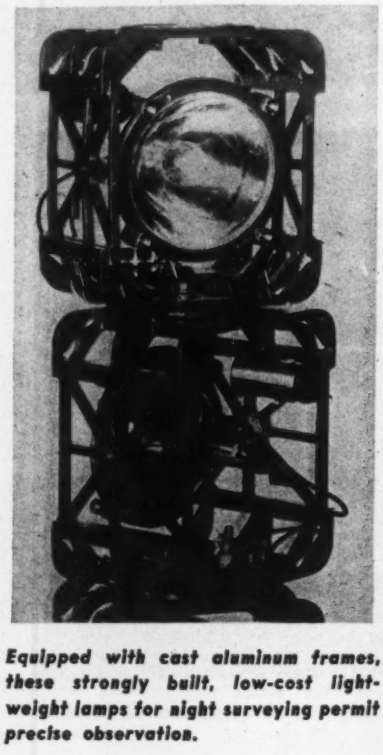
A NEW LOW-WEIGHT LAMP reasonable in first cost, stronger than previously available units, and permitting accurate placement with respect to the station mark has been developed for night surveying. Built of cast aluminum, the unit was designed for use as an illuminated target for precision triangulation surveys at night, when the effects of atmospheric refraction are minimized.

Basic requirements for the new lamp were, in their order of importance: (1) To provide a powerful ray of small divergence; (2) To develope a design permitting as many as four or five lamps to be "stacked" over a station, with the focal points of the reflectors lying in a vertical line through the mark; and (3) To incorporate rugged construction, light weight and simplicity of manufacture.

A narrow beam is furnished by the new lamps by virtue of a carefully designed reflector, and a bulb having a specially concentrated filament in the form of a small cylindrical coil, whose axis lies along that of the reflector. A 3.7-volt, 0.6-ampere bulb of this design develops a beam candlepower of over 10,000 at a distance of 95 ft., while a 6-volt, 1.5-ampere bulb of the same design gives a beam candlepower of 70,000 under similar conditions.

Another important feature is that a number of the lamps may be fastened together to form a vertical stack. Since the ray from each light, no matter in what direction it is pointed, issues from some point on a vertical line passing through the station mark, it is possible to observe simultaneously on the column of lights with a theodolite or transmit from a number of stations, thereby increasing the rapidity with which an area may be surveyed.

With wooden lamps, it is difficult to keep the top and bottom surfaces of the lamp frames flat and parallel, as the wood may warp. Sheet metal lamps also are difficult to construct so that tops and bottoms will be parallel, and unless the sheet stock is heavier than is otherwise desirable, these lamps do not satisfactorily retain their shape. These considerations led to the present design of cast aluminum. The grillwork pattern of the lamp illustrated provides strength and lightness, the corners being strongly braced.



Equipped with cast aluminum frames, these strongly built, low-cost lightweight lamps for night surveying permit precise observation.

Weight of the lamp is about 5 lb. (Experiments are being conducted with lamps of an alloy of magnesium to reduce the weight to less than four pounds.)

When surveys are being made with these lamps in flat terrain, they are usually mounted on high, steel towers, and in rough country on wooden stands on the peaks of mountains. In either case, the lamps are subject to strong winds, and not infrequently the wind pressure is sufficient to destroy wooden-cased lamps when four or five are steaked together, despite the fact that the corners are strongly braced. This factor was considered in building the lamp illustrated.

The new design is easy to manufacture. Each element of the frame has four machined surfaces at the joints and by the use of jigs and gang cutters, all four surfaces on two castings (one set) may be machined at once. This method insures the uniformity of the parts and parallelism of the top and bottom surfaces. A ring-shaped bearing surface is machined at top and bottom for the junction of the lamps. The threaded center hole at the bottom is large enough to allow the top fastening bolt of the next lower lamp to pass through, so that any number of lamps may be fastened together.

The fastening bolts are stored in the lamp in a tubular cup held in spring fingers. This cup is quickly and easily made by cutting thin tubing to length in an abrasive cut-off machine. A thin bottom disk cut by the same machine from rod of proper size to fit the inner diameter of the tube is then soldered in place.

The glass bezel in front of the reflector is attached by thumb screws having an interrupted section of thread, so that the screws can be backed off when replacing a bulb, without becoming lost.

The new lamp was developed under the writer's direction.

...ualls coming down from the hills complicate construction in Alaska, keeping building materials wet much of the time.

Protective Materials for Arctic Exposures

Harlan H. Edwards
Former Assistant Chief Engineer, Siems Drake Puget Sound, Seattle, Wash.

***Contents in Brief**—Climatic conditions are so bad in coastal areas of Alaska that contractors on military bases found great difficulty in painting structures and in covering roofs with ordinary roofing materials. As a result studies were made to develop paints and roofing materials that could be used. Also studied were methods for prime coating finished lumber to reduce swelling and to check decay. In both, the results were unusually successful and some of the resulting products hold promise for peace-time use.*

THE VASTLY INCREASED use of Alaska and other areas having difficult climates has brought about a great change in many materials to enable their use in rapid construction operations. In Alaskan coastal areas the severity of exposure definitely limits the carrying on of outside operations. Due to alternating freezing temperatures, high humidity, fogs and driving rains and to the damaging effect of salt spray, painting and the application of composition roofing are particularly restricted unless the materials and methods are altered to suit the adverse climatic conditions.

Realizing the importance of this problem and knowing the limitations of existing materials, the writer undertook its solution during the summer of 1941, shortly after becoming engaged in Alaskan operations.

A universal-coverage paint

Differing from normal paint requirements wherein paints are made for specific materials and points of use, it was obvious that the paint needed for the protective concealment of structures at military bases must be such that it can be compactly shipped and can be applied either by brush or spray over wet surfaces as well as dry, in light rains or heavy fogs, in temperatures below freezing as well as in hot, dry weather, and over all kinds of materials likely to be encountered out of doors. Such paint must set quickly in the wet and cold to provide a non-glossy, permanent coating high in hiding power and weathering qualities. It must also be available in a number of colors.

This all-inclusive specification was discussed with a number of paint manufacturers in the Northwest in anticipation of a possible emergency call for paint from the various military areas. Some of their paints could be applied over damp surfaces but not in light rain. Others could cover wood or steel but not asphalt or glass or concrete.

The search appeared to be bogging down for lack of experienced technical guidance until the problem was presented to the staff of the I. F. Laucks Laboratories in Seattle, which, through cooperative discussions and tests, produced a material that went well beyond the requirements. By Dec. 7, 1941, this paint had withstood the test of 75 exposure cycles in the weatherometer, equivalent to two years of severe weather, the only signs of failure being some dusting.

This single material for all-purpose

and all-weather coverage was necessary not only because of the prevalence of severe weather and the great distance from the source of supply, but also it was needed due to the remote locations of some of the areas to which travel was difficult and where it was impractical to send a large variety of paints for the different types of surface to be covered. Its quality which permitted rapid application by large spray rigs was a real advantage, since the ability to make a quick change of color during bad weather might be vital.

For simplicity in production and use, it was determined that the primary colors of red, yellow, blue, black and white would be the only ones shipped, other than the standard olive drab, since any color necessary for protective concealment could be produced by intermixing and the slight addition of colors-in-oil.

Paint of amazing character

The paint produced, known as resin emulsion camouflage paint, was so formulated that, supplied in a concentrated paste form for compact shipping, it was not harmed by freezing in the can, and the normal thinning was with water. Dependent upon the climatic conditions and needs encountered, however, it could be thinned with alcohol, aviation gasoline, petroleum thinner, turpentine or kerosene for application under difficult weather conditions. It was equally applicable by brush or spray to wood, concrete, asbestos cement, metal, glass, masonry, bituminous-coated surfaces, galvanized iron, or cloth, and when sprayed on, it was of a buttery consistency such that it stayed put wherever it landed. When thinned with water or alcohol and applied over bituminous or creosoted surfaces it did not burn or stain through and could later be recoated satisfactorily with standard paints. When the proper thinner was used, its application to any of these or other surfaces when damp, frosty or thinly iced did not prevent setting and drying of the film nor adversely affect the adhesion since it was made to set free-to-touch in 4 hours and dry hard in 18 hours at 40 deg. F. and 80 percent humidity.

The anticipated emergency arrived with Pearl Harbor, and when large quantities of paint were suddenly required, substantial shipments were made within a week. The cost was such that a minimum saving of approximately 50c. per gallon was effected as compared with bid costs of previously purchased standard exterior paint while performing an otherwise impossible task at an application rate equal to ten or more five-room houses per day per coat per crew of two men and a large spray rig.

Though initially developed and produced under the writer's direction for projects on which he was engaged, this paint soon attracted national attention and has since been adopted for general military use. It is capable of production having various degrees of infra-red reflectance, when such is required. A still-further improvement involving now-scarce materials awaits postwar production.

Improved interior paint

Interior paint was similarly difficult to apply using standard materials that were then specified. Time of drying was from four days to a week in the low temperature and moist air, and the resultant surface, though smooth and glossy, absorbed dirt and was difficult to wash clean. Separate paints had also been specified, each for different types of surfaces, all contributing to the general difficulty of speedy job operation.

Search therefore was instituted to find or develop paint of high hiding power and controlled penetration capable of use on plasterboard, plaster, concrete, asbestos wallboard, woodwork and metal whether damp or dry.

For surfaces where dampness was likely to be deep-seated, such as wood, concrete or plaster, a commercial one-coat breather-type interior oil-base industrial finish was used, capable of application over all interior surfaces, requiring no sizing and having the characteristic of controlled penetration such that it would remain wet for at least ten minutes and within this period could be brushed out, showing no laps, and would dry to a flat, washable finish in 12 to 24 hours. Through this paint film the excess water contained in the material being painted could evaporate without loosening the film or discoloring the surface.

For reasonably dry surfaces, three paints were developed as improvements over existing standards. They were a pigmented primer-sealer, an eggshell finish and an interior gloss enamel having the following advantages: (1) Higher hiding power was obtained to enable one coat to do the work of two coats; (2) drying time for recoating was reduced to 24 hours or less when under adverse conditions, such as 40 deg. F. and 80 percent relative humidity, yet producing a hard, tough, elastic film; (3) the vehicles of all three were made to be compatible and could be intermixed to secure any degree of gloss and high washability, and (4) both eggshell and gloss, or a mixture of them could be successfully used as radiator enamel where needed.

Performance specifications were initially developed through the cooperation of one paint manufacturer, though the paint ultimately was purchased under bid from several manufacturers. Final bid prices showed a minimum cost saving of 65c. per gallon over previous bids on the originally-specified materials. Total yearly savings in the cost of exterior and interior paints ran well over $80,000.

Special protective paints

Other protective materials for special purposes were investigated and specifications for them were adopted. Among these were quicker drying paints of greater value for rust-inhibitive and protective purposes on metals exposed to weather and salt spray, a high-grade bituminous-type paint for metal exposed to salt spray and submergence within the tidal range which could be recoated when wet or below water, and a special wax finish for concrete floors that could be applied as a curing and protective coat immediately following hardening of the wet concrete and later easily cleaned and re-waxed for finished floor use without turning white, discoloring or loosening under continued moist and alkali conditions. All of these materials, whether less in cost or not, either saved time in application or provided a serviceability much greater than that previously obtained.

Controlling decay and swell

Another material and process related to painting which was adopted for general use was a colorless toxic water-repellent dip for rot and dimension control on all finished lumber and millwork. This was a generally clear liquid of highly penetrating qualities containing in solution, toxics of the tri-phenol type developed by researches connected with the wood industry, and other materials having

tantial water-repellent character- which limit to a large extent the rption of water and the expansion contraction occurring due to ge in moisture content of wood ucts.

a protection against warping damage by wet weather during ment and job storage, the original ifications for interior-finish wood- called for paint priming, then lling and wrapping for export ment. This took much time and space for painting and drying, in- sed the labor costs beyond pro- ionate value, and due to prema- bundling, it sometimes resulted hipments arriving on the job so together with paint that the ma- l was useless.

ollowing a careful investigation, ifications were issued requiring lace of the initial paint prime coat, inimum three-minute dip in a water-repellent solution, for h three standard makes were ap- ed. This dip was applied to all erial for sleepers and subfloor over , all interior and exterior finish, ens, sash, doors, exterior wood g, exposed interior woodwork all other kiln-dried material unless rwise specified.

ince Alaskan conditions were so h more severe than those gener- encountered in the States, to as- adequate results, a 40 percent tiveness was finally required in- d of the 30 percent generally en- ntered elsewhere.

o insure satisfactory penetration absorption, a maximum moisture ent of 20 percent was placed on ension lumber to be treated, 12 ent on finish and 8 percent on work, sash and doors. When wood gles were used, instead of break- the bundles, dipping in oil stain rebundling, it was found possible, sing the toxic water repellent hav- permanent colors added in solu- , to obtain satisfactory results by ping the unbroken bundle, thus viding color, weather resistance, the added value given by the pre- ion of rot and fungus growth.

Policing by manufacturers

o control satisfactorily the mill treating-plant application, re- nsibility for checking and certify- compliance with the specification assigned to representatives of the ufacturers of the toxic water repellent. This method of policing the industry proved successful, since it was to the interests of the manufacturer as well as the consumer that the work be done well.

Under these requirements, the bidder stated in his bid whose dip solution would be used; the treatment plant was required to advise the manufacturers inspector when the work was to be done; and the manufacturers agreed to maintain periodic inspection and testing control over the application of their material, to supply stamps for plainly and indelibly marking the woodwork so treated and to supervise the certification to the purchaser that the treatment was properly made.

Commercial applications

Application of these toxic water repellent dip stains is now coming into more common use, while a similar paint for dip coat which is quick in drying and has high hiding power has been originated and is being developed for application to all types of finished lumber by roller at the mill. With these materials, the finish color can be applied as a stain or as a one-coat paint which after dipping or application does not run or sag, yet has good durability, thus combining in the dip the toxicity and dimension control with a complete four-sided stain or paint job at a fraction of the previous time and cost for back-priming alone. Both of these materials act to prevent premature checking or cracking of the lumber, a very valuable feature, particularly when unseasoned or wet lumber must be used.

Changes in roofing

Improved field service and lower costs were obtained through the application of sound engineering knowledge and experience to the problems in roofing and waterproofing. Thousands of rolls of roofing were being shipped into the Alaskan areas where heavy snows, frequent thaws and almost constant wetness and fog prevailed.

Standard mineral-surfaced 90-lb. cap-sheet roofing was being purchased in one-square rolls which occupied more shipping space ($2\frac{1}{12}$ cu. ft.) than two-square rolls of the best grade of 55-lb. smooth sheet ($1\frac{8}{12}$ cu. ft.) and per square contained less felt, the basic factor in roofing (10.8 lb. per square as compared with 13.5 lb. per square). Mineral-surfaced roofing, in addition to the increased shipping weight and space occupied by the mineral and the excess asphalt necessary to retain it, provided a mechanical roughness for adherence of snow and ice which, when thaws came, would make it possible for the weight of the slipping snow on a sloping roof to tear the roofing and cause early failure.

For use in areas of high winds, roofing was produced in one-square 18-in. rolls wrapped two to the standard 36-in. package for shipping. This type caught the wind much less during application, and provided laps, cementing and nailing areas every 16 in. for one-course work; all of great advantage for permanence in those areas. Asphalt cement was provided in 5-gal. pails and nails in 100-lb. kegs instead of being supplied in the small cans and packages common to the trade for packing with the rolls as "fixtures."

Roofing replaces shower pans

A standard floating-membrane type of roofing was adopted to replace sheet lead and copper pans as a waterproofing under concrete shower floors and under concrete decks out of doors. This eliminated the occurrence of leakage due to the corrosive action of concrete in contact with lead, saved cost in purchasing, shipping and laying, and eliminated the use of critical or strategic materials.

Wet-weather applications

By the use of an especially designed type of roll roofing, asphaltic cement and a different method of laying than the usual hot-mopping, built-up composition roofs were made available for installation in the continued wet weather of the Aleutians. Previously, hot mopping had been found impractical due to the frequent and unannounced rains or dripping fogs.

The new method involved closely coupled operations. A special asphaltic cement was mopped cold onto the prepared roofing and the various layers were rolled into contact, thus simultaneously rolling *out* all water. For this, the standard three-section linoleum-type roller was used, with nailing as usual.

Unrelated to the foregoing yet illustrative of the diverse problems characteristic of work in such outlying areas was the method of control of

Wherever possible, buildings were located in sheltered spots as a protection against Arctic storms and the very high win

a "red water" condition that developed in the water supply systems. This condition was particularly troublesome and potentially dangerous to the life of the hot-water installation. Analysis of the water disclosed an approximate Ph of 6, the presence of dissolved oxygen and the lack of appreciable quantities of minerals. Analysis of the red deposit showed little other than red iron oxide, all indicating that the original galvanized coating on the piping had been removed by the exceptionally pure water and that corrosion of the steel pipe interior was proceeding at an increasing rate.

There were several methods of approach to this problem, but since it was out of the question to remove any portion of the system for repairs, a means of providing a protective coating to the pipe interior was necessary, without shutdown. Having had experience in the use of sodium hexametaphosphate, which is produced in food grade under a trade name for water treatment, and recalling the experience of several cities in its use for red water troubles, the local representative of the manufacturer was found, tests were made and the remedy prescribed. It consisted in the dosing of the water at the source or at the beginning of the iron piping system with the commercial grade of sodium hexametaphosphate, using an initial dosage of 6 ppm., reduced in a few days to a uniform dosage of approximately 2 ppm.

As an emergency measure, this dosage was by drip of a solution into the supply line near the source, while the later and permanent method was by proportioning feeder introduction along with chlorine.

This treatment first increased the red water condition by the loosening of the scale, then gradually eliminated it as the protective coating of iron phosphate was built up on the pipe interior.

An interesting side light on the result of the application was the comment by the manager of one of the laundries in the area that, in addition to the elimination of the quantity of fine and coarse rust coming through the pipes, the treatment evidently further softened the water so that less soap was required to do a better job. Doubtless other beneficial effects might have been observed, had time and personnel in the field been available.

The foregoing illustrates a few of the possibilities present when competent engineering services are combined in an executive capacity with purchasing and job operations to coordinate the purchase specifications with the peculiarities of job nee and with availabilities on the ma rials market. The demands made up industry to develop and improve a ternate materials where shortages e ist, and to produce new materials withstand climatic or other severe e posures have spurred research hitherto undreamed-of accompli ments. When the war has been w and mens energies are again direct into peacetime pursuits, these ma rials will be available at moder cost to provide more durable, l costly and quickly built structu and equipment for all.

In these paint studies the auth was assisted by Edw. L. Graef, f merly chief estimator, Siems Dra Pugent Sound; H. L. Rippey, tec nical director, and Al. Bowen, ch chemist, I. F. Laucks Co.; J. C. Pe ter, sales manager, and H. Zeis chemist, Seattle Division, Gene Paint Corp.; Jack H. L. Harris, fie technician, and H. E. Gross, ch chemist, Schorn Paint Co. In the pi corrosion investigation the writer w associated with H. E. Sovereign, co sulting mechanical engineer, and W R. Gibson, sales manager, Northw Filter Co., agents for Calgon, Inc. D velopment of roofing procedure w aided by Ed Holland, engineer, T Parafine Companies, Seattle, Wa

WPB Viewpoint on . . .

What's Ahead for Waterworks Utilities

Arthur E. Gorman
Director, Water Division, Office of War Utilities, War Production Board
Washington, D. C.

***tents in Brief**—Military necessities will continue to determine the liability of most materials for water utility maintenance and construction. However, the War Production Board is geared to meet requests from ties in order that adequate water service will not be impaired. In par-ar, cast iron and cement-asbestos pipe, hydrants and iron-body valves no longer in the critical category*

y public utility operators are tly concerned over the possible t of coming events on their sched- programs for meeting anticipated umer demands during 1944. The easing tempo of major military paigns has brought war produc- to a maximum, has caused a tight- g of materials available for civil- construction, and created a short- of manpower. Truly we have en- d a vortex of events that has no llel in history.

he sharp but necessary readjust- t in our national economy that ught our war program to full frui- in 30 months has been severe and called for our best efforts. But e has been no lack of ingenuity resourcefulness on the part of r utility operators. They have car- their share of the war burden with itude and distinction; and we are they are prepared to meet the job d, whether it be "more with less" r a long period of warfare or a k reconversion to absorb the blems that would be thrust on us sudden ending of the war.

Military needs dominate

ntil victory is definitely indicated, hannels of service and production war purposes must be held open eet military contingencies. Trans- into its effect on scheduled water y construction, this means that ects calling for critical materials manpower—unless essential to the war effort—should be deferred. It does not mean that planning of improvements should stop if manpower is available. But it is obvious that until war issues are cleared, current or future commitments as to material and fabricating capacity for equipment may be subject to changes which would make the launching of long-term programs at this time fraught with uncertainties.

Water utilities have a continuing responsibility to maintain service to consumers in the face of war conditions; and there need be no uncertainty as to their ability to obtain essential operating supplies and equipment. The War Production Board, through the Office of War Utilities, is prepared to help all utility systems to maintain efficient operation at least for minimum essential service. The existing system of priorities and material allocations whether by delegation of authority to utilities as under Order U-1, or by special authorizations, provides this assistance.

"Looking ahead for 1944, there is every indication that water utilities will meet their obligations. However, they should 'hold the line,' in their requests for materials and manpower this summer. Material and equipment is available for 'must' projects, and it is desirable that maintenance and operations are held to a high level."

In turn, utility systems have a reciprocal responsibility to maintain their plants in good operating condition so that service may be rendered during the war, using a minimum of replacements. There is continuing evidence that many water utilities are not maintaining facilities as they should be to assure adequate service in case of a long war.

Manpower and water

Currently, the manpower situation is critical. In certain areas where war production is concentrated, such as the Pacific coast and the metropolitan areas of Detroit, Akron, Cleveland, Buffalo, Niagara Falls, and Hartford, manpower is very tight. These places are known as "urgency areas," and construction projects requiring more than 25 men in addition to the normal staff of the utility or contractor must receive special approval by local WPB committees.

Water utilities should prepare to lose for military service employees who are physically fit and under 26 years old. As to older employees of draft age, especially if they are key men in operating positions, the War Production Board is prepared to assist in obtaining deferments when appeals are filed by utilities. In this connection the results of a recent canvass of water utilities has revealed that the percentage of key men under 30 is relatively small. The small utility systems will be more seriously affected by the Selective Service draft than the larger ones; and the private systems will be affected to a greater degree than those that are municipally owned.

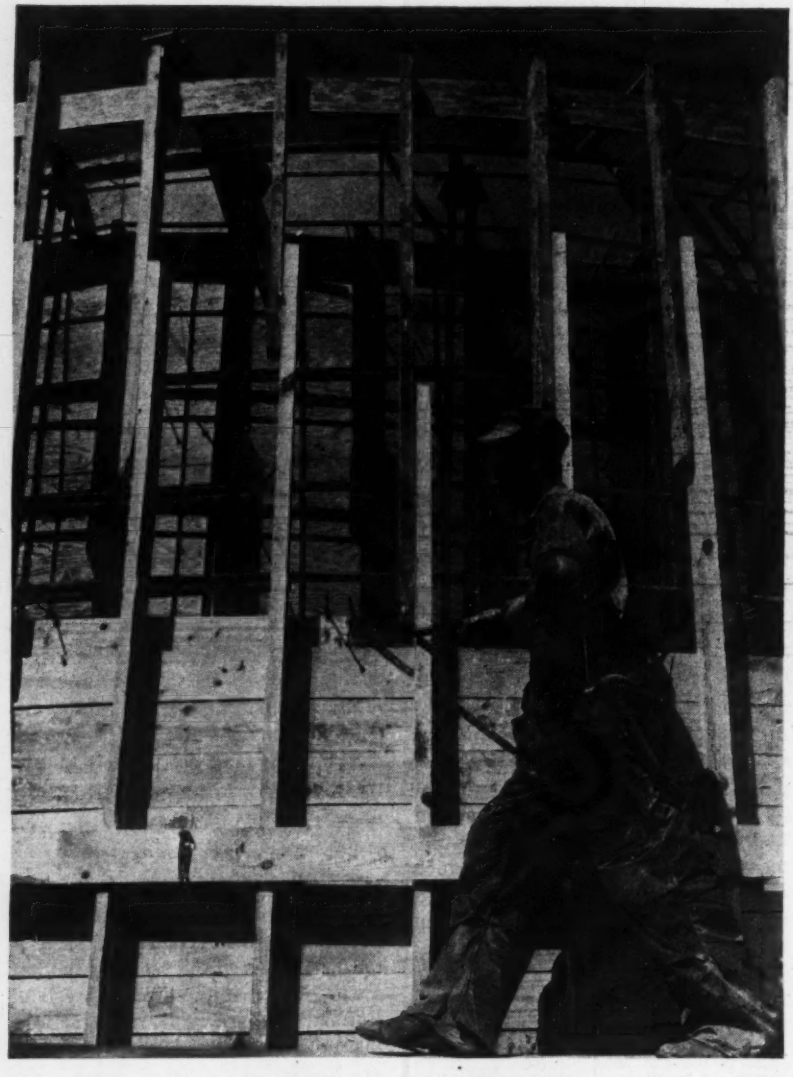


Fig. 1. Manpower and form lumber—a critical shortage of each explains in part why waterworks construction has been curtailed throughout the nation.

The materials situation continues to change. In recent months lumber, in all sizes under 6 inches has become very difficult to obtain. The need of lumber for packaging of equipment and supplies for overseas shipment and for construction essential to expanded military and foreign relief programs is great.

Demand for this lumber exceeds the available supply, and a shortage is likely to continue for many months. This is unfortunate because those other basic essentials in construction —reinforcing steel and cement—are now available. In particular, the construction of dams, reservoirs, basins, filters, and similar structures requiring form lumber will be affected unless substitute material for forms can be utilized.

Steel plate and sheet are still critical, and the indications are that this situation will continue until a more precise course of the war is established. In particular, this will affect the construction of large steel pipelines and elevated tanks. In many water systems there is now real need for elevated tanks; and when plate again becomes available, early relaxations to permit their construction are definitely in order. Structural steel in most shapes is available for essential projects.

Pipe of cast iron and cement asbestos for water transmission and distribution systems is not critical and, provided manpower is available, essential work involving these materials can proceed. The availability of valves and hydrants now permits utilities to install them in distribution systems accordance with good waterwo practice.

Equipment demand is heavy

Pumping station equipment co tinues to be in great demand and production of many items is un controlled schedules. Provision made, however, to protect the ne of domestic utilities, and essen equipment can be made available. the case of large units, utilities sho make their needs known well in vance so that production can be pr erly scheduled.

Equipment for water-conditioni and treatment is available for es tial projects, but specifications sho if possible, not include critical ma rials and components such as non-f rous metals and alloys, fractio horsepower motors, and anti-fricti bearings.

Copper, the availability of wh seemed encouraging a few mon ago, is now a tight item. However, relaxation of the M-9-c-4 (amendm of Jan. 24, 1944) now permits wa and gas utilities to use copper tubi in inventory for service connecti Utilities are urged to use this tubi where it will do the maximum of go —especially for services under pav streets.

Water meters are in great dema generally and especially on the We Coast where extensive housing pro ects have recently been complet Although the iron body "Victo Meter" requires more manpower manufacture than the standard b bronze meter (and is still not gen ally desired by utilities) the contin shortage of secondary metal has ma it inadvisable to rescind Limitati Order I-154, Schedule 1, pending outcome of the military programs.

Fortunately, the rains of late Fe ruary and March that were more less general throughout the nati have put water utilities in a favora position as to supply for 1944. Pri to these rains, the area of potent drought which started last summer eastern Texas, Oklahoma, and Lou ana had spread progressively acr the South and East Central, and Mi dle Atlantic states until a seri shortage of water supply during th summer appeared imminent. Co sidering the fundamental importa of water supply for war productio direct and indirect—and what pr

2. More than ever before, water utilities must maintain their equipment in prime operating condition with a minimum placement parts. This calls for constant checking of mechanical facilities.

might have arisen had a nation- drought developed, this nation truly been blessed with adequate all since this war began.

Looking ahead in 1944

oking ahead for 1944, there is indication that water utilities meet their war obligations. They ld "hold the line" in their re- s for materials and manpower summer or until the outlook of nt campaigns and their effect on nt stockpiles and production re- ments is more clearly defined. rial and equipment is available must" projects, and it is desirable maintenance and operation are to a high level. The possibilities -setting this deferred construc- in supply projects by a well-or- ed water conservation campaign timely and intriguing.

e demand for materials for for- relief, rehabilitation, and recon- tion must be reckoned with in Therefore, utilities with sched- programs for construction and cement will do well to make their known in advance of expected ery dates.

Fig. 3. Heavy rainfall early this year and generally satisfactory stream flow throughout the nation promise adequate supplies for water utilities in 1944.

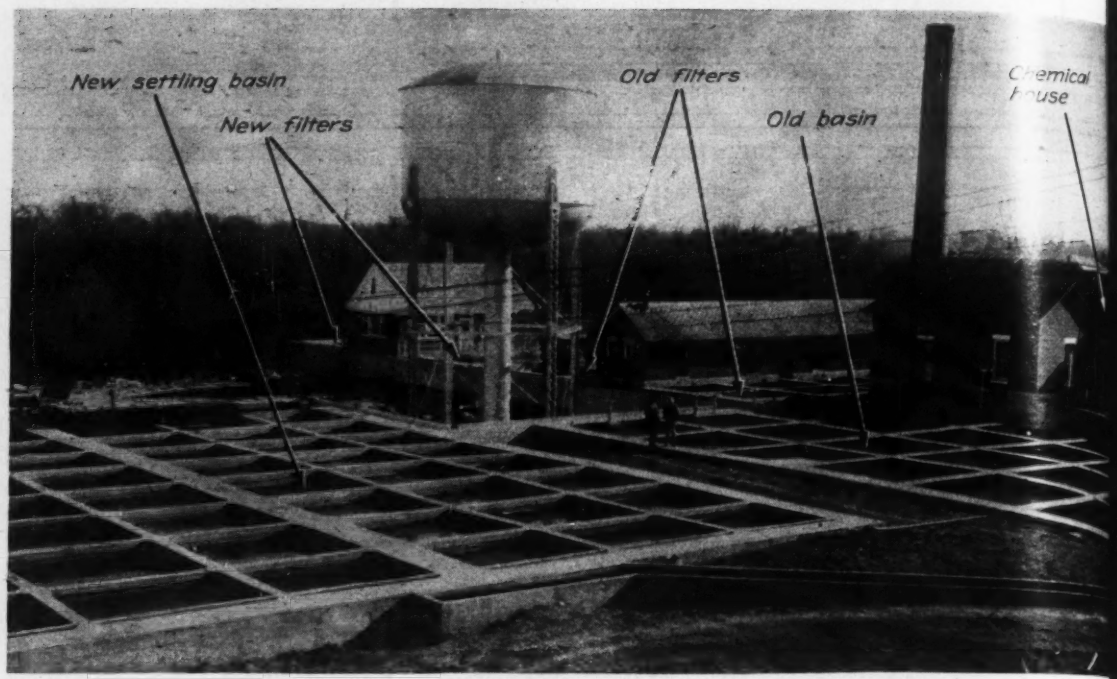


Fig. 1. Jackson, Miss. adds new equipment and increases the capacity of its waterworks plant without interrupting ser

Wartime Waterworks Modernization

***Contents in Brief**—Converting the inadequate water purification plant of Jackson, Miss. into a modern plant of increased capacity, without interrupting service, called for careful designing and well planned construction procedure. Despite priority restrictions and other wartime difficulties the job was completed in ten months.*

RECONSTRUCTION of a water purification plant during wartime is not a simple problem. And when it involves the installation of equipment in an existing, antiquated plant that must be kept in continuous operation, design and construction call for careful execution. Such is the case at Jackson, Miss., where the city is modernizing its 10 mgd. filtration plant and enlarging it to 14 mgd. capacity.

The need for this water supply improvement resulted from the recent rapid growth of the city. Its present population of 83,000 represents a 25 percent increase within the past three years. Although some nearby war activities caused an influx of workers, no decrease in population is expected after the war.

A careful survey of the city's water needs, conducted in 1941, disclosed that the most economical method of plant expansion was to convert one of the two existing settling basins into a rapid-mixing chamber and flocculation basin, and to construct additional filters, a settling basin and a reservoir.

This modernization program will cost some $240,000, of which 25 percent is being financed from FWA funds and the remainder from city funds. In addition to this project, $25,000 worth of cast iron distribution water mains were installed to expand the system in built up areas.

New facilities

New facilities include: A chemical storage house containing five dry feed machines; two rapid mixers; two separate mixing basins equipped w slow mixing flocculators; a l-mg. pacity reinforced concrete set basin; two 2-mgd. rapid sand filt and a l-mg. clearwater reservoir.

In addition, there has been stalled a 100,000-gal. second-h elevated steel washwater tank. A chlorination unit also is available reduce the bacterial concentration the raw water and to assist in the trol of tastes and odors.

The new coagulation basin lies jacent to the old settling basin. is to be kept in service. The filters, located above the new filt water reservoir, have been built jacent to the existing filters. concrete flumes connect the raw ter inlet to the rapid mixing cham and the flocculating basins to both old and the new settling basins. flumes also connect the settling ba to the old and the new filters. The water flume contains a Parshall fl meter, and some flash mixing is tained by applying the chemicals prior to the hydraulic jump.

kson takes its water supply from earl River where an antiquated ft pumping station houses three l. and one 8-mgd. electric pumps, deliver raw water to the filtra- plant through 2,000 ft. of 24-in. ron pipe. A 10-mg. raw water oir "rides" on this supply line nish emergency storage.

Existing equipment

old water plant had a mixing er of the over-and-under wood type; two settling basins with a d. rated capacity at a 3½ hr. de- period; ten 1-mgd. rapid-sand ; and a 620,000-gal. clearwater oir. Two 5-mgd. and two 6-mgd. high-service pumps distribute tered water throughout the city. 500,000-gal. elevated steel stor- nks are connected to the city for emergency supply. In addi- wo reciprocating steam pumps mgd. and 6 mgd. capacity are ble for emergency use only. All g facilities remain in operation the mixing basin and the g basin, the latter being con- to a flocculator basin.

nstruction operations got under une 1, 1943, with the new sedi- tion basin being built first. It ecessary to complete this unit the old basin could be taken service and remodeled to house pid mixers and flocculators. The eled and enlarged water puri- n plant was completed and in operation on April 1, 1944.

Service as usual

as imperative that all construc- nd remodeling be scheduled so cause no interruption in the op- n of the plant. For instance, completion of the new settling it was connected by flumes to mixing chamber and the exist- lters, to permit continuous op- n of the plant.

second major unit to be con- d was the million-gallon fil- water reservoir, on top of which built the rapid-sand filters to- with their operating house. lines were extended to serve w filters.

this stage of construction one settling basins was cut out of and remodeled to house the mixing basin and flocculators, as to support the new chemical g. A new drive pit for operating the flocculators was built along the outside of the remodeled settling basin, and another drive pit was installed in the old mixing flume, on the opposite side of the flocculators.

Washwater tank is second-hand

The 100,000-gal. elevated washwater tank located between the new settling basin and the old filters, was constructed as an independent unit. An opportunity to save considerable critical material was afforded by purchasing this 17-year old tank from the city of Springfield, Ill., where it had been out of service for some time. It was knocked down, shipped to Jackson and reerected at the water plant.

All excavation for the sedimentation basin and filtered water reservoir was accomplished with a dragline, the spoil being used to elevate a nearby service road. Foundations are in blue clay and design pressures used were 2,200 lb. per sq. ft. Concrete was mixed on the job in a 2-sack batch mixer and wheelbarrowed into place.

Built for permanency

Since the new plant serves as the sole source of water supply for some 83,000 citizens of Jackson, it was not constructed as a temporary wartime project. The requisite material priorities were readily secured, but construction was retarded at times due to delays in securing materials.

Every effort was made to avoid the use of critical materials wherever substitutes would not affect the safe and efficient operation of the plant. For instance, substructures were reinforced concrete and both the chemical house and the operating house for the new filters were constructed for concrete and brick.

All flumes were reinforced concrete instead of the usual cast iron pipe. And they are of the open type since the danger of water freezing in them is quite remote. Timber handrails protect the elevated walkways along the flumes and around the filter beds. They will be replaced with steel pipe after the war.

Windows are encased in wooden sash instead of steel. Timber trusses support the chemical building roof which includes asphalt shingles on the slopes and a tar and gravel covering where the roof is flat. Both of the new concrete buildings are faced with brick, and jack arches of brick are used in lieu of steel lintels over the

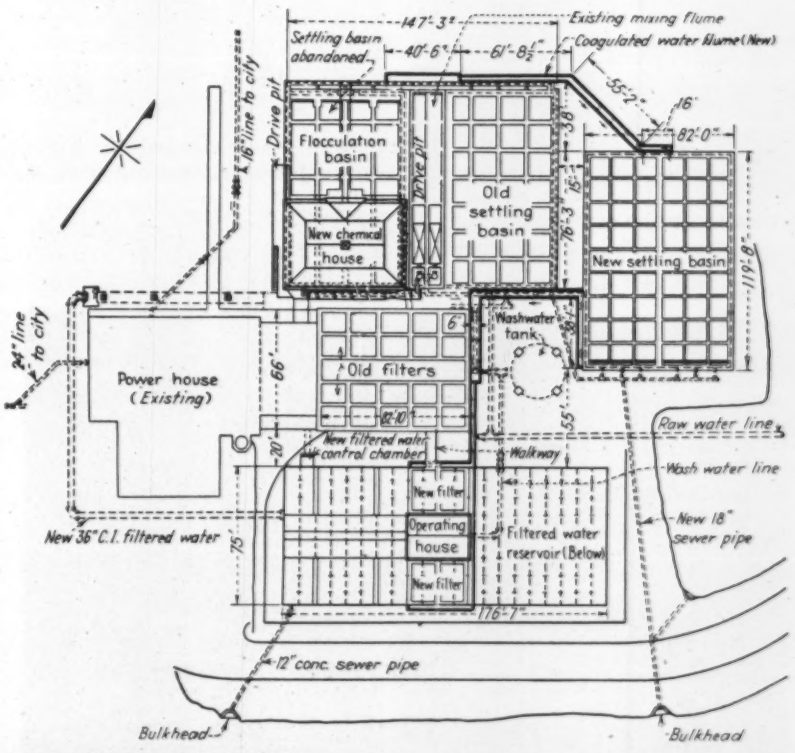


Fig. 2. One old settling basin houses the new flocculators and rapid mixers while supporting the new chemical house. Other new units include a settling basin, rapid-sand filters and a clear water reservoir.

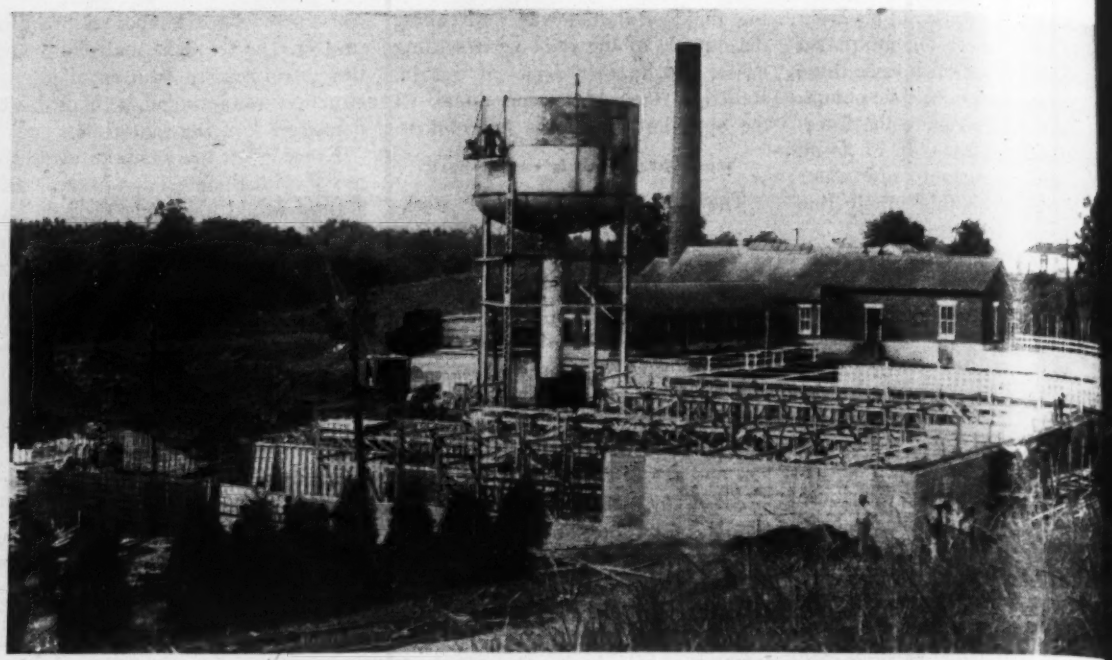


Fig. 3. Continuous service was furnished by completing the new settling basin first and connecting it by flumes to the mixing chamber and filters. A secondhand washwater tank was installed to save critical materials.

windows. Some saving in critical electrical material was made by employing electrical metallic tubing instead of the usual rigid steel conduit.

Large quantity of cast iron pipe

Where permanency of construction was imperative, only time-tested materials were installed. These include some 110 tons of cast iron pipe and fittings. About 235 lin. ft. of 36-in. bell and spigot cast iron pipe connects the clearwater reservoir to the high pressure suction control chamber.

The raw water intake line needed no relocation but some new 24-in. cast iron pipe connects it with the intake flume at the mixing chambers. New Venturi tubes were installed in both the existing 24-in. and 16-in. water mains leading to the city. Hydraulic sluice gates operate at the influents to the new filter beds.

New chemical building

A one-story chemical building is superimposed over one end of the old settling basin that was taken out of service. It contains a floor area measuring 62 x 45 ft., with a 15-ft. width housing the rapid mixing and ch ical feed machines. The remain 30 ft. width is devoted to the sto of chemicals. Principal chemicals u are carbon, alum and lime in addi to chlorine. The dry chemicals co packaged and are hand-fed into machines. The chemical feed chines are equipped with a dust lecting unit. Concrete columns s porting the floor of the chemi building were set directly on the fl slab of the old settling basin.

Two separate basins house th lines of flocculators each. And spa is provided in the old settling ba to add two other mixing units in t event it becomes necessary to incre the plant's capacity. The floccula which revolve from 2 to 3 rpm., a operated through chain-connect gears by a 5 hp. electric motor.

Rapid sand filters have 30 in. filter sand supported on 6½ in. graded gravel resting on an und drainage system of concrete latera The strainers are 12 x 24 in. p forated concrete blocks in which a housed porcelain nozzles. The bloc were cast in vibrated steel forms. T nozzles extend through the filter flo to the concrete laterals.

The ten old filter beds were co pletely overhauled three years ag and new strainers and filter sand we installed. The method of back-wa

Fig. 4. Bottom slab of the new settling basin is underlain with 4 in. of 6-in. tile drains to take seepage from the adjacent 10-m.g. raw water storage lake.

was changed at that time from a mbination air and low-velocity wa- wash to a high-velocity wash with es up to 24 in. This change re- ired the installation of new con- te washwater troughs to handle the her rate of wash.

To build new intake

Plans have been completed for a intake structure adjacent to the sent low-lift pumping station. This ject is estimated to cost $197,000 construction is planned to start soon as governmental approval is ured.

The undependability and obsoles- ce of the existing raw water intake ilities were demonstrated all too rly last January 14 when a com- e failure occurred in the pumping ipment putting all intake pumps of service for a period of 36 rs. At this time the city was en- ly without water for nearly 24 rs.

The existing intake built 30 ft. out o Pearl River is extremely unre- ble. It consists of a 30-in. dia. tiron pipe extending out from the mphouse, with a 90-deg. elbow at intake and protected by a per- ated metal box screen. The inlet hangs from a timber pile bent. ice in recent years anchor bolts e failed through corrosive action, pping the intake pipe to the river tom.

This intake cannot be cut out of vice long enough to install a new since the limited storage of aux- ry supplies of both raw and filtered ter will not furnish sufficient water the city for any length of time. e of the four raw water pumps was talled in 1941. It will continue in vice. The other three pumps, two which were installed in 1921 and purchased in 1914 will be aban- ned.

Dual raw water line

As a safety factor in assuring a tinuous supply of water to the , a new 24-in. cast iron pipe will installed between the proposed low- pumping station and the filtra- plant. This will supplement the sting 24-in. raw water line.

The new reinforced concrete intake ucture will be supported on timber ing. It will house a "traveling e" water screen, with provisions installing a future screen when- ever necessary. It also will house a 10 mgd. auxiliary pump to serve while the three new pumps are being installed and revisions are made to the present pumphouse.

One new pump has been purchased recently to operate in parallel with the pump installed in 1941. They will feed raw water through the new 24-in. line at a rate of 12 mgd. The other two will discharge 10 mgd. into the existing raw water line for a total delivery of 22 mgd. at the filtration plant.

This additional construction will not increase the total capacity of the purification works, but it will insure a continuous water supply to the city.

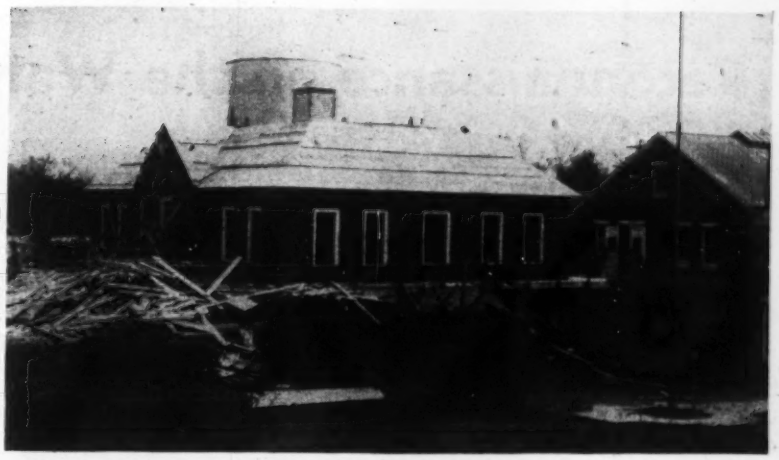


Fig. 5. Built over one end of the old settling basin, the new chemical house contains the dry-fed mixers, a chlorinator and storage space for packaged chemicals.

Fig. 6. Filter bed strainers are 12 x 24 in. perforated concrete blocks.

Fig. 7. Reinforced concrete columns and heavy cross beams support the roof of the filtered water reservoir which, in turn, carries the new filters.

Construction personnel

The contract for modernizing and enlarging the old purification plant was held by the M. T. Reed Construction Co., of Jackson. The Chicago Bridge and Iron Co. dismantled, moved and reerected the washwater tank. L. O. Brayton and Co., Jackson were the contractors on the distribution system extension.

Black and Veatch, consulting engineers, Kansas City, Mo., made the preliminary study, prepared the plans and specifications and furnished the field inspection. They were represented on the job by Bert F. Steves, principal engineer and T. D. Samuel, resident engineer.

Baxter F. Wade, superintendent of waterworks, and city commissioners R. M. Taylor and A. F. Hawkins, approved all work in connection with the modernization program.

Reconnaissance on the Waterworks Front

Ellsworth L. Filby
Field Director, Committee on Water and Sewage Works Development
New York, N. Y.

***Editor's Note**—In travelling from coast to coast as field director for The Committee on Water and Sewage Works Development, Mr. Filby has had a unique experience. For almost a year he has done nothing else but talk to and live with waterworks men. We asked Mr. Filby for an informal report on some of the things he saw and thought about, and when the manuscript arrived he stated: "This is what resulted from talking to myself."*

IN CAMPAIGNING for "Blueprint Now," the writer has had an unusual opportunity to meet with hundreds of waterworks men, to talk with them, perhaps to impart an idea or two and always to acquire ideas about the waterworks profession. Here are some of the thoughts and questions that have been uppermost as a result of travelling some 45,000 miles.

Fig. 1 Behind the man behind the gun, the water supply facilities of the nation did not fail during the crucial days when war production soared to dizzy heights.

An old song goes—"Get out and get under." This philosophy has been taken to heart by waterworks men who show a strong tendency to "get out" of city council domination and "get under" a non-partisan utility commission. Billings, Mont., has a very workable system: Here a water board directs the department, but the president of the city council is on the three-man water board and all construction contracts clear through the city council after consideration by the water board. Further economies would result from merging water and sewage utilities under single management. Nothing new in the idea, however. Auburn, Maine and El Paso, Texas have had such management for years and Akron, Ohio has adopted it with a modern kink or two. In Oakland, Calif., good management of the East Bay Municipal utilities district (water) has resulted in several cities within the district asking that sewage collection and treatment be added to the Districts' jurisdiction.

More and more of the municipalities are getting better management and waterworks income diversion is becoming a pastime of yesteryear. St. Louis with nearly eight million dollars cash-on-hand in the water department and a six-year postwar program of $12,436,000 shows how a charter requirement of "waterworks money earned is for the water department" can be adhered to with satisfactory results.

Out of debt! A goal few water utilities attain yet it can be done and improvements made if management keeps water utility money for the water utility—and this applies to both public management with earnings siphoned off by the council and private management with holding companies, management groups, etc. Out in Colorado there are two water districts—one out of debt and one heavily in debt. Yet the supply is the

me, distribution problems are the me and they both operate in the me but opposite sides of a town. e explanation for the difference in rnings is to be found only in differ- ce of management.

Look toward the hills

Lift up thine eyes unto the hills hence cometh thy help—so says the od Book. The smart waterworks an will look at the mountain pplies developed for New York and ston metropolitan districts, and if is near the hill country he better art—oh just riding around—look- g for the "mountain water" that me day will be demanded by the blic. Little Rock, Ark., Greenville, C., and Seattle, Wash., all went to e hills and now Atlanta, Ga., is sting eyes afar.

Distance is shrinking these days— en Key West, Fla., goes 100 miles the mainland for water and the etropolitan District of Southern lifornia planned far, far ahead to ilize Lake Mead for catching the lt so the Parker Dam supply could nction efficiently. National forests ake excellent catchment areas for ater supply—and also preserve a ry worthwhile natural resource and creational area. Waterworks men ould have a close liaison with for- try and wild life authorities. Up in aine they acquire watershed lands d reforest. And out in the Pacific rthwest they log the watersheds. oth have good reasons for their tions.

Metropolitan districts should be- me more and more in evidence as e countryside develops into urban eas. So called "authority" acts now the statute books may be widened scope so that water supplies— tter in both quantity and quality— ay be furnished to industrial and mestic consumers. Perhaps the Authorities" may purvey raw or rtially treated water to cities and dustries for further conditioning. The states might possibly be the velopment agencies since they ready possess the right of eminent main and the necessary resources capital for a long-term develop- ent.

Groundwater supplies are dwind- g, stream flows are becoming more d more erratic—and all consumers e demanding processed water— om cool enough for condenser pur-

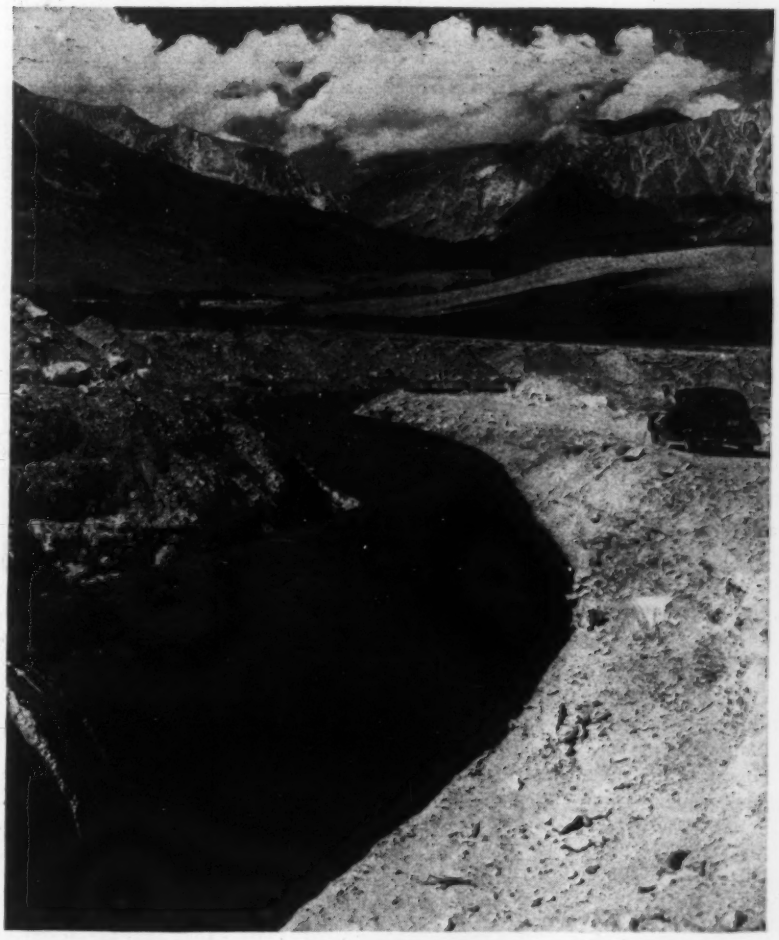


Fig. 2. Present trends, states Mr. Filby, indicate that "mountain water" will be demanded by the public. In his opinion, the smart waterworks man should now be looking toward the hills for new supplies.

poses to soft enough for soap economies. And there is a growing tendency for separate industrial water supplies patterned after the successful system at Birmingham, Ala. Certainly the promoters of that supply didn't know a war was coming but the supply was ready when the crucial days were with us. Houston, Tex., and the state of New Jersey also are interested in such development.

Planning for the future

Waterworks planning for the future seems strangely circumscribed by legal strictures when we find, for example, that federal rivers and harbors bills provide for waterways dredging, relocation and regulation with utter disregard for public water supply features. What is needed is coordination and cooperation with all the legal hamstringing removed.

River diversion, flood control and navigation interests should be secondary to public benefits of water supply and waste disposal. Why should water be made to flow under a bridge but in so doing leave an intake or outfall sewer high and dry? Or why should a channel be dredged in a harbor containing a 60-inch water intake line that later will have to be lowered at "no cost to the federal government", and while it is being done a city is crippled as to fire protection and water supply?

Incidentally, federal aid is a touchy subject. We find New York City, Chicago and some of the other larger municipalities foremost in the cry for federal aid—but the grass roots towns are "fed up" with the red tape and administration—we nearly said mal-administration—of the various

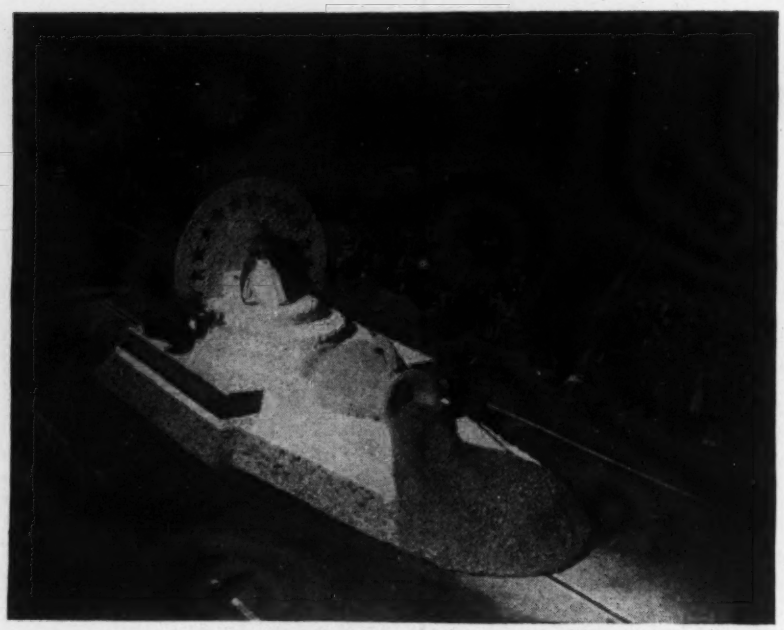


Photo by Dick Whittington

Fig. 3. Not every water utility can participate in a Tournament of Roses parade, as does the Metropolitan Water District of Southern California, but there are many other ways by means of which better public relations may be practised.

alphabetical agencies down to the Lanham Act. Why must government be so complicated? Can it be that all American cities are inefficiently administered?

Changing horses in the middle of the stream will be a prime subject for political discussion in the near future. Yet, many water systems change horses, if we can apply that term to an engineering consultant. Long-range planning calls for steady, gradual attainment of a goal. Will it not be easier if the "wheel horse" selected by a water utility be permitted to carry through to the ultimate development of a project over a period of years? Witness Des Moines, Iowa.

Orchids to state engineers

If anyone deserves an orchid it is the state sanitary engineer. An orchid or an "Oscar" for men who have universally earned the approbation of the waterworks profession. Quiet, industrious, self-effacing, yet always plugging for better design and operation, these chaps have contributed much to the art and science of safe and satisfactory water supply. From such old timers as Messrs. Weston, Ehlers, O'Neill and Waring, to the youngest neophyte in the game today, we dutifully say that if the "Blueprint Now" campaign has from a slogan become a reality, the credit in large measure should go to them.

Off to war have gone most of the younger men and Roger Esty, superintendent at Danvers, Mass., startles himself when he finds the average age of his staff is above 50! Waterworks men generally are in the gray-haired class. Postwar planning of personnel is a good program that won't cost a cent to initiate and you can blueprint it now! Where do you need "new blood"—youngsters who can be trained to take over when you step down? Have you trained someone so that when you retire, you can do so in full confidence that your ideal of service will be carried on? Big business does it and waterworks operation certainly is big and important business. It would not be a bad idea to lay the groundwork now for additional technical personnel, and keep a weather eye open for the boys who will return from the wars.

War has its good points—at least the interconnection policy fostered by the Office of Civilian Defense seems to be worthwhile even if its efforts only joined neighbors together so that mutual help is "on tap" in case of emergency. And during the war—did you hear about the failure at Xville? You did not! To the chagrin of our enemies the waterworks facilities of the ation did n fail. Water producti seemed t commonplace to de ve an "E award, yet water is war produ and often a manufact d one.

Public relations are important

Ever wait around t see a wat superintendent? Next ime you d look about the office. Do you s the George W. Fuller Award certi cate proudly framed on the wa the registration certificate from th state or local waterworks school, a orderly desk with a table in front o it? Or do you find a pile of dus covered prints in a corner, unopene catalogues and magazines stacked up some loose charts and a tattered ma of the town with the distributio system drawn on it? Which is yo office? I wonder why so many wai ing rooms have hard benches an often drab surroundings. One ea mark of a live and efficient organiz tion is a pleasant reception room— where the girl asks if you would ca to peruse a report of the water depar ment or look over a souvenir bookl of highlights.

Call the water department!—fo anything. The writer sat awaiting th superintendent at Raleigh. Buzz— the office secretary answered. It wa a soldier in trouble; he had to get marriage license and could not ge from camp into the city in time t have a medical examination, and th Mrs.-to-be was en route for a week end ceremony and a brief honeymoo before overseas orders. The state la says that without a medical certificat no license could be issued and it take three days for a medical examinatio Did the water department refer th soldier to the health departmen already closed? No sir! War or n war the path of true love must be smoothed. Mrs. Water Departmen Secretary got busy and located a medico who said he could make th examination in a few hours any day Ready to serve—anytime, anything that's the water department!

Always ready to serve

How often is this readiness-to-serve a forgotten asset. A large capital investment is made for mains and hydrants for fire protection. But does the city tax levy include a hydrant charge that will accrue to the department? Does John Jones have a private well for his store and

his nose at the water depart-
except when there is a fire
e wants SERVICE—yes, all
ls! And how about the hotel
the A.W.W.A. section met
has a private unchlorinated
or the vacant lots held for
tment" which increase consid-
when water is available? It
be denied that readiness to
is an equitable charge.

of this leads to the question
municipal superintendents and
water companies are so reti-
s to their postwar programs?
must so many things be kept
ential? There is nothing amiss
ing the public what the needs
nd the steps being taken to
the desired results. There is
atter of water softening, for
le, about which much interest
nifested. Women's clubs are
ularly vitally concerned and it
be mutually advantageous for
o be fully informed.

entire matter of customer rela-
is something worth studying.
he public into your confidence
l sorts of means—arranging
for school and other groups
h the plant and establishing
grounds on the water property
me of the obvious things to do.
as and electric companies, the
nes, the railroads and other
s advertise their service feat-
There is no reason why water-
should "hide their light under
hel."

Better waterworks meetings

s leads up to the matter of
y relations among waterworks
It is my observation that these
st developed by group meet-
The program of the Maine
Utilities Association, as well
of the New Hampshire group,
es for one-day meetings every
month; these include a paper
in the morning or possibly an
ion trip, a luncheon (and what
ptuous one if Auburn, Maine
over, New Hampshire are typi-
amples!), and then a lively
on session. The formal paper
owed by questions from the
-free open give and take dis-
n—and adjournment comes
dinner. This opportunity to
ay from routine matters for a
verily the "pause that re-
."

The problem of distance in our western states preclude such one-day sessions but Texas has some 16 local associations that meet frequently and then comes the statewide short school meeting. The latter, grandaddy of all short schools, was conceived by Vic Ehlers, state sanitary engineer, who still guides its course, even though it has grown into a three-ring affair with international aspects.

North Dakota fellows meet and bring their Canadian neighbors into the sessions. And when men come 300 miles to find out how to develop a public water supply in a small town, you are getting down to the "grass roots."

The American Water Works Association statewide sections seem to be the ultimate of development for mutual advancement of waterworks men. The "break-up" of the large sectional groups into smaller state groups seems best for everyone—especially those from the average and small size plants. Regional and national meetings are for the "big shots."

All waterworks men will be interested in the monumental history of their profession, which has been compiled by M. N. Baker, who for more than half a century was sanitary engineering editor of *Engineering News-Record*. The American Water Works Association is getting this book ready for publication, and we hope that it may inspire the formation by A.W.W.A. of a library of waterworks literature available in one place for record and research.

An award for safety

This leads to another suggestion—could A.W.W.A. sponsor a safety first campaign. Such campaigns are

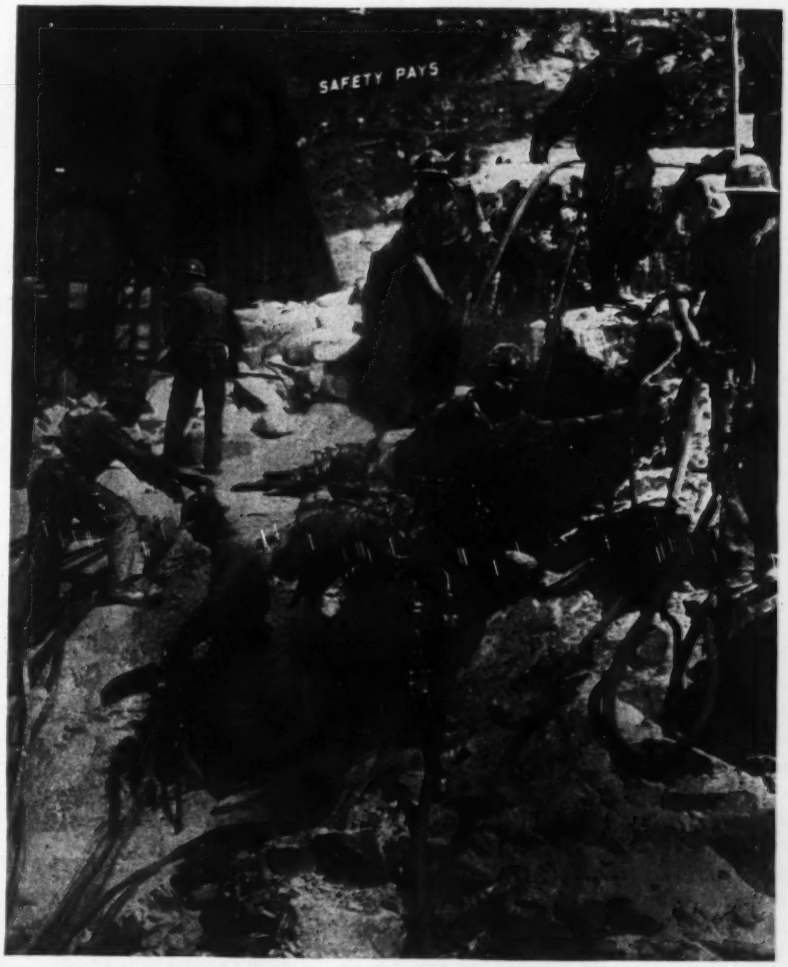


Fig. 4. Initiating a campaign for "Safety First" in waterworks properties need not wait until the postwar period. The slogan painted on the hill reminds these construction workers—as it should all waterworks men—safety pays.

underway all over—in manufacturing plants, railroads, private utilities and municipalities. How many water departments are preaching and practising "safety first?" Just one more fol-de-rol to worry about? Well it will come, along with unionization of labor for the die has been cast (even strikes have been called on waterworks properties; ask Los Angeles and Philadelphia!) But for safety first—how about a national award among cities of different classes or even just a listing by A.W.W.A.—as the American Medical Association provides in connection with typhoid fever reduction? There would be merit in an honor roll of safety—from accidents as well as from disease transmission.

A final word

Finally, permit me to make a comment on water quality and standards. The traveler on a train drinks water that is certified to meet the U. S. Public Health Service standards. The traveler in a hotel 100 yards from the station drinks water—period. Recalling the days of trying to get cities to meet the old Treasury Department standards, and the trials of coachyard sanitation, we wonder if the new Public Health Service standards are not a trifle "beyond the pale" of the average water department. Excellent as they are for a goal to be attained, are we not exposing ourselves to severe criticism by having the goal so unattainable? If some of our largest city supplies could not be fully certified under the old standards how can the new ones be met?

The new standards, of course, apply only to waters used in inter-state carriers (railroads, steamships, etc.) but with the prestige and influence of the Public Health Service behind such standards there is a tendency for some states to adopt them without consideration of local conditions. And with the requireme for exa tion of so many m re distrib system samples a tre endous l being placed on loca and stat oratories, a load that today is cially hard to assume. Might it worthwhile to have the stan remain in a tentative categor tried out, for say two years carrier watering statio in each to see if they are reasonable, more important—attainable?

There has been compens received during the past 9 m that cannot be valued too high has been a privilege to meet so waterworks men and to appear b them in discussions of mutual lems. And there has been comp tion in the form of pride, for proud to be of a profession tha never failed in time of stress and now is taking steps to insure future of America—to be neither with too little nor too lat the peace that looms on the hor

Abyssinian Driven Tube Well Has Virtues in Porous Soils

Colin Johnston Robb
Consulting Engineer, Belfast, Ireland

A great volume of literature has appeared dealing with sunk and artesian wells but practically nothing has been written on the "Abyssinian" or driven tube well which is one of the most ready means of obtaining an ample water supply where rock or incompressible clay are not met in the geological stratum.

The title "Abyssinian" was first given to these wells in 1864 during the Abyssinian expedition when they were used by the Royal Corps of Engineers with much success in that water-barren land. They were only used singly not in series as a few gave an ample supply for the troops. Strange to relate the writer, as a fully-blown sapper in the Royal Engineers, during World War I, assisted in driving tube well in neighboring Egypt.

The Abyssinian well is best suited for tapping the water bearing strata to depths up to 20 ft. though I have seen them used in driving up to 100 ft. The well tube consists of a fine quantity wrought iron or copper-bearing steel pipe, the latter being the best from the penetration point of view, the bottom end being finely perforated and shod with a hard steel driving point.

The first length of tubing should be short and driven into the ground with a mallet. The next length of tubing is screwed to the first and a hard steel clip known as the "monkey jumper" is clamped on the second length about 4 ft. above the ground. A tripod having been erected over the tubing the "monkey" or driving weight which has a hole up the center is placed on the tube and is lifted by a saddle rope over a pulley at the head of the tripod and let fall on the monkey jumper thus driving the tubing into the earth.

When the depth of the water bearing strata is not known frequent tests should be made with the pump. This is also necessary to clear the dri pellets of earth which find their into the tube through the perfora like worm casts. They can only b moved by filling the tube with and pumping it out. When the commences to pour from the tub water bearing bed has been rea Trouble will be experienced with and earth in the valves of the p perhaps for a time but this will as soon as a natural reservoir f around the perforated end.

Good yield at low cost

The yield of a 2 in. tube well be up to 600 gal. per hour, and required for factories or the li series of tubes can be driven.

Provided the stratum is suit such supply is simple to obtain is very pure, being free from sur water pollution. The cost is very considering other types. When water is found or rock is struck tubing can be withdrawn by means of screw jacks.

It seems surprising that engin do not make more use of the sy of water supply which has proved an outstanding success. haps the reason is that it has tried too often in geological fo tions that are not suitable and in sequence its merits are discred

Postwar Waterworks Prospects

Elsie Eaves
Manager, Business News Department
Engineering News-Record

***nts in Brief**—Waterworks projects proposed up to March 31, 1944, stwar construction total $299,535,000, within the half-million mark of lume budgeted for a maximum postwar year. Projects reported in anning stage, however, total only $92,000,000, 30 percent of the m year's budget. The District of Columbia and the States of Wash- Texas and Maryland lead in the 15-month progress report both in per capita of waterworks proposed and in plans underway.*

AR WATERWORKS construction per year is budgeted by *Engi- News-Record* from 2½ times to s its prewar average, or from 0,000 to $300,000,000 annu-

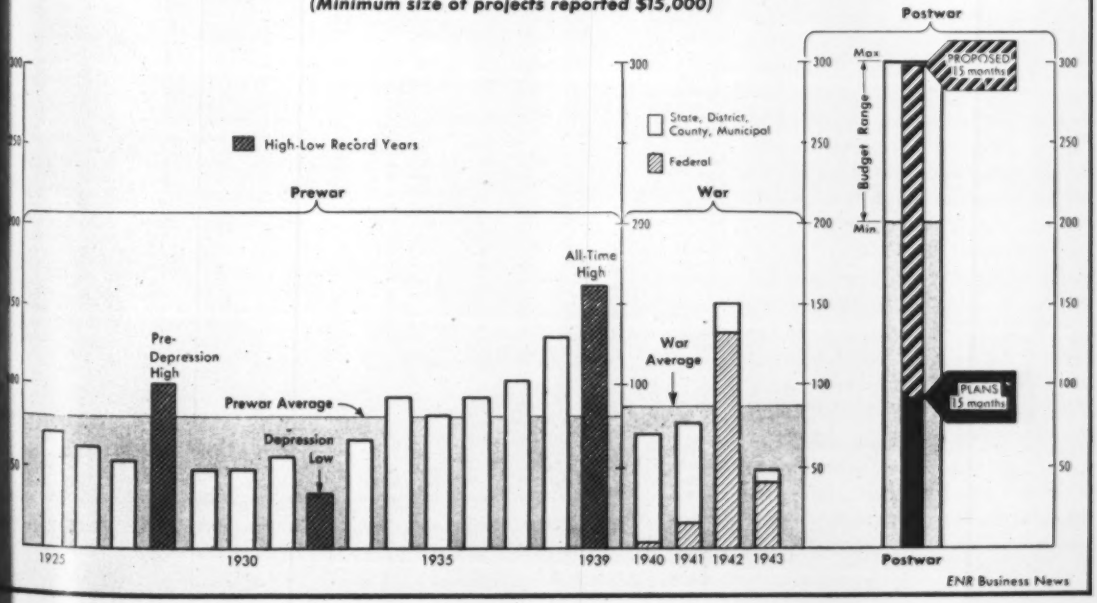
pendent of this budget, the Public Health Service has esti- the cost of additional water facilities needed in the United to be $683,300,000, 6,455 im- ents to existing supplies to 02,340,000 and 4,863 new sys- cost $180,960,000.

of these estimates offer measuring posts for gaging progress in planning. Proposed waterworks projects on record total $299,500,000 or approximately the equivalent of one maximum budget year. But the actual preparation of plans lags. Only 31 percent of these proposed waterworks projects are in the planning stage compared with 62 percent for bridges, 43 percent for sewerage, 37 percent for streets and roads.

Proposed projects volume reported to date amounts to 44 percent of the U. S. Public Health Service inventory of additional water supply facilities needed. Four states so far show proposed totals for waterworks construction that exceed their totals in the inventory of estimated needs. These are New Jersey, whose proposed projects are 816 percent of U.S.P.H.S. estimated needs; Texas, 318 percent; Washington, 166 percent; California, 155 percent. Massachusetts will join this company in the next, or 18-month progress report, since a block of $19,000,000 worth of projects has come in since these figures closed which alone would raise the Massachusetts project total to 112 percent of the U.S.P.H.S. estimated need.

The highest dollar volumes reported to date in proposed waterworks projects by states are for: California, $72,871,000; New Jersey, $54,235,000; Texas, $41,913,000; Michigan, $22,875,000; Washington, $18,421,000; Missouri, $15,411,000; Ohio, $12,572,000; Maryland, $10,804,000.

PROPOSED POSTWAR WATERWORKS CONSTRUCTION AND ANNUAL VOLUMES REPORTED TO ENR, 1925 TO DATE
(Minimum size of projects reported $15,000)



Plans are underway in greatest volume in these states as reported to date: Texas, $30,801,000; Ohio, $11,834,000; Washington, $9,238,000; Maryland, $8,300,000; New York, $6,731,000; District of Columbia, $5,405,000; Nebraska, $5,338,000.

Applying the per capita test, the leading states in waterworks planning at the 15-month goal post, both in proposing projects and in starting planning are: State of Washington, $10.62 per capita proposed, $5.30 per capita, plans started; District of Columbia, $8.90 per capita in projects proposed, $8.15 per capital in plans started; Texas with $6.51 per capita in projects proposed and $4.80 per capita in plans started; and Maryland with $5.93 per capita in projects proposed, $4.55 in plans started.

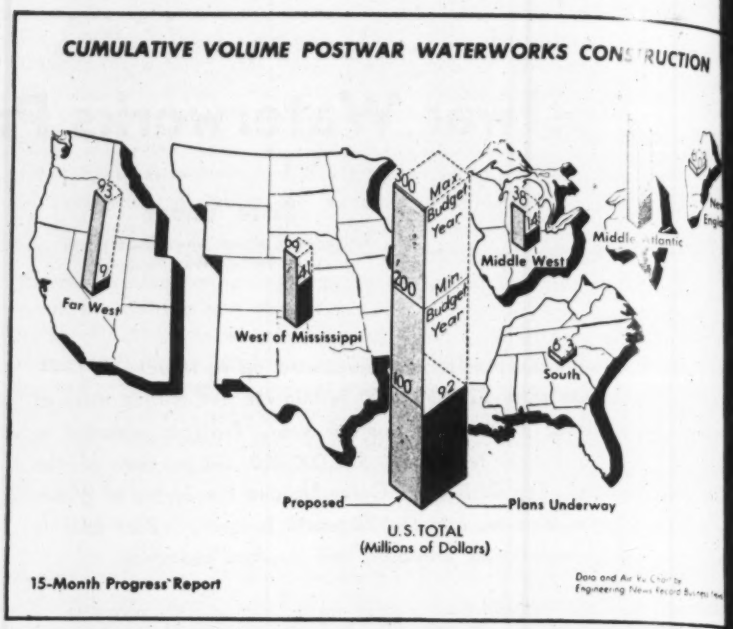
New Jersey shows $13.00 per capita in projects proposed including the Raritan River development, but only $0.80 per capita in plans underway. California with $10.53 per capita in proposed projects reports a negligible amount in the planning stage.

On the other hand Nebraska shows $4.08 per capita proposed and $4.05 per capita with planning started.

The U. S. average is $2.25 per capita for proposed waterworks, $0.70 per capita reported with plans underway or completed. Compare this with Canada's record—$3.42 per capita proposed, $1.96 in the planning stage.

Enough states have gone over the top of the "Inventory of Additional Water Supplies Facilities Needed," which has been released by the U. S. Public Health Service, to imply that it represents minimum requirements and is therefore a conservative estimate of future waterworks development.

Fourteen zero states, those for which no proposed postwar waterworks projects have been reported to March 31, show the following volume of estimated need: Vermont, $2,860,000; Delaware, $890,000; West Virginia, $3,150,000; Georgia, $12,760,000; Alabama, $6,910,000; Mississippi, $5,550,000; Kentucky, $12,150,000; Tennessee, $5,420,000; Montana, $1,700,000; Colorado, $5,720,000; New Mexico, $1,030,000; Idaho, $2,920,000; Arizona, $4,170,000; and Nevada, $150,000. These states show an estimated need of $65,380,000 in postwar waterworks, almost ten percent of the national total.



STATUS OF POSTWAR WATERWORKS PLANNING BY STATES

As Reported to Engineering News-Record

STATE	Population 1940	Proposed Waterworks Construction	Proposed $ per Capita	Waterworks Plans Started	Plans Started $ per Capita	Planning % of Proposed	Estimated Need*
Maine	847,000	$215,000	$0.25	.....	....	...	$2,060,000
New Hampshire	492,000	70,000	0.14	$55,000	$0.11	79	440,000
Vermont	359,000	.....	....	.....	....	..	2,860,000
Massachusetts	4,317,000	4,335,000	1.00	180,000	0.04	4	20,830,000
Rhode Island	713,000	605,000	0.85	.....	....	...	10,140,000
Connecticut	1,709,000	615,000	0.36	25,000	0.01	4	3,310,000
New Eng.	**8,437,000**	**5,840,000**	**0.69**	**260,000**	**0.03**	**4**	**39,640,000**
New York	13,479,000	9,267,000	0.68	6,731,000	0.50	73	37,810,000
New Jersey	4,160,000	54,235,000	13.00	3,320,000	0.80	6	6,650,000
Pennsylvania	9,900,000	8,320,000	0.84	665,000	0.07	8	36,140,000
Maryland	1,821,000	10,804,000	5.93	8,300,000	4.55	77	47,230,000
Dist. of Col.	663,000	5,900,000	8.90	5,405,000	8.15	92	12,000,000
Delaware	267,000	.....	....	.....	....	...	890,000
Mid. Atl.	**30,290,000**	**88,526,000**	**2.92**	**24,421,000**	**0.81**	**28**	**140,720,000**
Virginia	2,678,000	1,312,000	0.49	69,000	0.03	5	4,500,000
W. Va.	1,902,000	.....	....	.....	.....	...	3,150,000
No. Car.	3,572,000	725,000	0.20	.....	.....	...	11,860,000
So. Car.	1,900,000	960,000	0.51	960,000	0.51	100	4,250,000
Georgia	3,124,000	.....	....	.....	....	...	12,760,000
Florida	1,897,000	1,969,000	1.04	1,716,000	0.91	87	6,860,000
Alabama	2,833,000	.....	....	.....	....	...	6,910,000
Mississippi	2,184,000	.....	....	.....	....	...	5,550,000
Louisiana	2,364,000	1,010,000	0.43	25,000	0.01	2	5,680,000
Kentucky	2,846,000	.....	....	.....	....	...	12,150,000
Tennessee	2,916,000	15,000	0.01	15,000	0.01	100	5,420,000
South	**28,216,000**	**5,991,000**	**0.21**	**2,785,000**	**0.10**	**10**	**79,090,000**
Ohio	6,908,000	12,572,000	1.82	11,834,000	1.71	94	39,110,000
Indiana	3,428,000	245,000	0.07	230,000	0.07	94	15,790,000
Illinois	7,897,000	1,473,000	0.19	1,175,000	0.15	80	96,260,000
Wisconsin	3,138,000	630,000	0.20	400,000	0.13	64	21,130,000
Michigan	5,256,000	22,875,000	4.35	360,000	0.07	2	40,270,000
Mid. West	**26,627,000**	**37,795,000**	**1.42**	**13,999,000**	**0.52**	**37**	**212,560,000**
Minnesota	2,792,000	590,000	0.21	528,000	0.19	90	11,450,000
Iowa	2,538,000	175,000	0.07	90,000	0.04	51	10,670,000
Missouri	3,785,000	15,411,000	4.07	.....	....	...	38,040,000
Arkansas	1,949,000	140,000	0.07	.....	....	...	9,530,000
No. Dak.	642,000	210,000	0.33	145,000	0.23	69	8,260,000
So. Dak.	643,000	1,425,000	2.22	927,000	1.44	65	3,500,000
Nebraska	1,316,000	5,358,000	4.08	5,338,000	4.05	99	8,770,000
Kansas	1,801,000	1,525,000	0.85	1,415,000	0.79	93	8,260,000
Oklahoma	2,336,000	1,975,000	0.85	1,875,000	0.80	95	15,280,000
Texas	6,415,000	41,913,000	6.51	30,801,000	4.80	74	13,140,000
Montana	559,000	.....	....	.....	....	...	1,700,000
Wyoming	251,000	45,000	0.18	.....	....	...	2,030,000
Colorado	1,123,000	.....	....	.....	....	...	5,720,000
New Mexico	532,000	.....	....	.....	....	...	1,030,000
W. of Miss.	**26,682,000**	**68,767,000**	**2.58**	**41,119,000**	**1.54**	**60**	**137,380,000**
Idaho	525,000	.....	....	.....	....	...	2,920,000
Utah	550,000	769,000	1.40	.....	....	...	5,860,000
Arizona	499,000	.....	....	.....	....	...	4,170,000
Nevada	110,000	.....	....	.....	....	...	150,000
Washington	1,736,000	18,421,000	10.62	9,238,000	5.30	50	11,140,000
Oregon	1,090,000	555,000	0.51	40,000	0.04	7	2,920,000
California	6,907,000	72,871,000	10.53	15,000	....	...	46,750,000
Far West	**11,417,000**	**92,616,000**	**8.10**	**9,293,000**	**0.81**	**10**	**73,910,000**
U. S.	**131,679,000**	**$299,535,000**	**$2.25**	**$91,877,000**	**$0.70**	**31**	**$683,300,000**
Canada	11,420,000	$39,043,000	$3.42	$22,337,000	$1.96	57	

* U. S. Public Health Service Inventory of Additional Water Supply Facilities Needed.

YOUR ATTENTION, PLEASE!

One of these days, we hope soon, millions of demobilized service men will be looking to you for jobs. They will expect you to have this work ready. With the great reservoir of badly needed water works and sewage works maintenance, rehabilitation and expansion that has been piling up there can be no excuse for not having everything in BLUEPRINT FORM—READY FOR CONTRACT.

Once again, we join the Committee on Water and Sewage Works Development in urging you, for the welfare of our service men, your community, and the Nation at large, to determine tomorrow's needs today and BLUEPRINT NOW!

MATHEWS HYDRANTS

400 CHESTNUT STREET, PHILADELPHIA, PA.

ESTABLISHED IN 1806

Made by R.D. WOOD Company

MANUFACTURERS OF CAST IRON PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND SPECIAL CASTINGS

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

PRICES OF CONSTRUCTION materials in June show only minor changes from the preceding month. Cement is 20c. per barrel higher in Philadelphia as a result of the OPA-approved increase of last month. Douglas fir is $1.50 to $5.00 higher on 1- and 2-in. sizes in Kansas City; and is mixed in Minneapolis, up on most 1- and 2-in. sizes, but lower on rough timbers. Short leaf yellow pine prices remain unchanged from a month ago.

Structural clay tile is higher in Detroit. Common brick is off $1.00 per M in Kansas City. Vitrified sewer pipe is higher in Cleveland, Philadelphia and Pittsburgh.

Bricklayers' rates are up 7.5c. in Cincinnati and up 12.5c. in Minneapolis. Carpenters' rates are up 6.5c. in Minneapolis, bricklayers' and plasterers' up 12.5c., and hoisting engineers' are 10c. per hour higher. Common labor is 2.5c. higher in Minneapolis, and the former range of 75 to 90c. that prevailed in Detroit has closed up, with the higher rate now in effect.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK (8x8x16-in.; truckload del.; per block)		CONCRETE Ready Mixed
	Per bbl., C/L lots, bbl. for bags, cash dis. not deducted		incl. 40c. per										1:2:4, over
	Cloth *a*	Paper	Bulk	1½ in.	¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt. wgt. Agg.	50 c.y., del.
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$0.17	....	$8.00
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	.125	$0.125*w*	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	5.80
Boston	2.97*b*	2.72*b*	2.52	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	.13	.155*w*	7.25*m*
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.16	.16*x*	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15*w*	6.60
Cleveland	2.39	2.14	....	1.70*i*	1.55*i*	1.60*i*	1.73*i*	1.73*i*	1.73*i*	1.73*i*	.14	.15	7.30*i*
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	....	6.20
Denver	3.08	2.88	2.32	1.20	1.30	1.25	1.65	1.75	1.00	1.00	.15	....	7.25
Detroit	2.39	2.14	1.99	1.50	1.50	1.50	2.25	2.25	2.00‡	2.00‡	.14	.14*w*	7.00
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*wy*	7.50*n*
Los Angeles	3.00*v*	2.40*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.04*bb*	.10*aa*	7.25
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.12	.16	7.10*j*
Montreal	....	1.95*rs*	1.79*rs*	....	1.65‡*t*	2.05‡*t*	1.05*ct*	1.15*ct*	....	....	.14*t*	.14*ut*	7.90*u*
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	.19	....	9.25
New York	2.89‡	2.64‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	.14	.14*wcc*	7.50*k*
Philadelphia	2.53	2.28	2.08	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*w*	8.20
Pittsburgh	2.45	2.20	2.00	1.65‡	1.65‡	1.85‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	.13	.15*y*	8.00
San Francisco	....*u*	2.21	1.91	1.36	1.36	1.36	1.46	1.46	....	....	....	.20*aa*	7.55
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	.16	.16*y*	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable

	Bagged	Bulk
Buffington, Ind	$1.70	$1.65
Dallas, Tex	....	....
Hannibal, Mo	1.70	1.65
Hudson, N. Y	....	....
Independence, Kans	1.70	1.65
Ironton, Ohio	$1.60	$1.55
Limedale, Ind	....	....
Norfolk, Va	....	....
Northampton, Pa	1.75	1.70
North Birmingham, Ala	....	....
Richard City, Tenn	$1.80	$1.75
Steelton, Minn	1.80	1.75
Universal, Pa	1.65	1.60
Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.70
Montreal (8% sales tax incl.)	1.68	1.67

Discount 10c. per bbl. 20 days

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M 3x4x8‡ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.53*e*	$24.62*e*	$0.0740*e*	$0.1309*e*	$0.0802*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1384
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*	.14*r*
Birmingham	150.00	48.00	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	.....†
Boston	85.00	59.00	3.75	14.20	20.00	.....	.....	.....	.....	.....	.....	.....
Chicago	150.00	55.00	2.50/2.80*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/10*n*	.13/.15*n*
Cincinnati	120.00	50.00	.....	16.40	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	118.00	37.50	2.50	17.00	19.00	.095	.105	.11*h*	.16	.105	.10	.105
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	66.11	.....	11.00	.....	10.00	.....	.045*h*	.....	.....	.....	.....
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	.067	.0775	.1149
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.15
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	92.40	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	65.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.1225*p*
Philadelphia	140.00	58.00	4.06	15.00*r*	.....	14.00*r*	.....	.065*hr*	.....	.....	14.00*r*	.....
Pittsburgh	135.00	38.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	.11
St. Louis	.....	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.12½*h*	.648	.0525	.1125
San Francisco	.....	40.00	.....	10.90	21.15	10.90*g*	18.00*gr*	12.90	17.50*r*	9.50*gr*	.0825	.1125
Seattle	.....	60.00*c*	.....	10.90*i*	23.40*i*	.....	20.40*gi*	11.40*i*	.....	.....	.0525*i*	.0625*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. *m* Per thousand. † Available on priority only and quoted specially. *p* No steel drum shipments except to armed forces. *r* February 1943 prices, none later available.

Something You Should Know About Virginia, Minnesota

Who would want to part with electricity, running water, gas or the telephone? The prevalence of these low cost, convenient and dependable utilities has made the American living standard the envy of the world. Virginia, Minnesota has added a utility to these widely accepted public services—*steam heat* piped through the streets to practically every home, store and office building in the city, and hot water for domestic purposes, too.

The average cost per home owner is one-half to two-thirds the cost of operating a private heating plant. Obviously a power plant can be operated more efficiently than many small heating plants. Additionally, fire losses have been drastically reduced, the atmosphere is less polluted with smoke and gases, and there is no ash disposal problem.

Originally privately owned, the power plant, built for a saw mill, was purchased by the citizens who floated a bond issue for one-half million dollars to purchase the plant and install steam lines through the streets to the homes. The venture is a complete success for this thriving iron mining community of 12,500 population.

The factor of public ownership is secondary—the convenience and economy of this home heating service is the prime factor. Oak Park, Illinois (Chicago suburb), among other cities, has long been served by a privately owned dispenser of home heating. Many of our military establishments built for the present war are utilizing central heating.

When well-deserved peace comes, public funds will be spent to cushion demobilization. Postwar planners, particularly city planners, will do well to look into the Virginia, Minnesota central heating plan. Millions of home owners would welcome abolition of "furnace slavery." Trenching contractors in every community stand ready to provide fast, low cost digging of trench for installation of steam mains and service pipe with Buckeye Trenchers.

The idea is as practical as electric lighting was at the turn of the century.

Buckeye Traction Ditcher Co.
Findlay, Ohio

Buckeye

Convertible Shovels Road Wideners Trenchers
Spreaders R-B Power Finegraders Tractor Equipment

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	Angle Bars	TRACK SUPPLIES: Std. Spikes *e*	Tie Plates *e*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.75
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	3.05	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

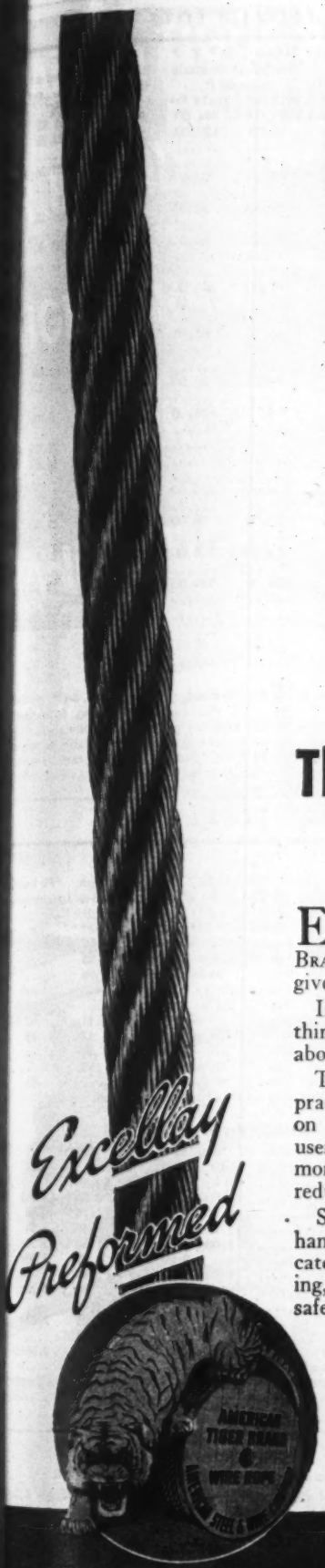
	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¼ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING— Per 100 sq.yd., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.40	$2.40	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	.....
Boston	3.85	3.51	3.36	$20 C.L	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.00	1.66	1.25	.1566	.....
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	.....
Denver	4.57	3.33*kl*	....	.....	....	26.50	26.50	1.97	1.45	.186	.....
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	30.00	30.00	1.68	1.26	.1584	2.88
Kansas City	4.19	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	2.874
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.81‡	2.73	2.73	.0	.10	25.00	27.00	1.80	1.34	.1701	2.73*d*
Montreal	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.25*i*	3.14*i*	.228*i*	.....
New Orleans	4.229‡*k*	2.52	2.52	.05	.10	19.00	21.00	1.82	1.35	.1715	2.875
New York	3.75	2.76*c*	2.76*c*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.66	3.82	....	.....	....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.697	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.825	2.675	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.80*e*	....	.....	....	34.50	38.50	1.93	1.42	1827	2.95*d*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *k* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market. *k* Quotation on changed basis; no actual price change. *l* Approximate Denver price out of wholesale stocks, based on Chicago area; not comparable with preceding prices.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE: Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b.: 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h*: 1 to 3 in., Black %	Butt Weld 3½ to 6 in.; Galv. %	Black %	Lap Weld Galv. %
Atlanta	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
Baltimore	53.00	.35	.60	2.70	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.5
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
Boston	55.40	.26	.50	2.20	6.25	.....	.....	.60	.....	....	....	....	....
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00‡*s*	170.00‡*s*	.75*t*	1.75*t*	57.1	43.4	54.0	39.6
Cleveland	54.75	.266*r*	.513*r*	2.115*r*	5.535*r*	90.60	139.40	.36	1.38	68.5	57.5	66.0	54.5
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	61.56	.29†	.52†	2.16†	3.00*n*	125.00	200.00	1.00	2.22	58.4	50.4	55.7	47.2
Detroit	54.75	.35	.675	2.70	7.75	135.00	200.00	.40	1.75	57.7	44.0	54.8	40.6
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.9	46.4	46.6	50.9
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	61.1	50.1	58.6	47.1
Minneapolis	57.47	.275†	.495†	1.98†	5.37†	.....	.....	.90	2.10	64.2	53.2	60.7	49.2
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.48*mt*	1.92*mt*	....	....	....	....
New Orleans	51.78	.26	.48	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3
New York	52.40	.308	.594	2.52	6.45	.....	.....	.60	1.40	64.9	53.9	62.4	50.9
Philadelphia	51.00	.315	.61	2.60	7.50	150.00	225.00	.45	1.75	56.6	42.8	53.6	39.1
Pittsburgh	56.00	.266†	.513†	2.295†	5.945	97.80	154.20	.85*q*	2.00*q*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
St. Louis	53.62	.28	.504	2.016	4.50	85.00	220.00	1.25*j*	2.25*k*	56.4	42.6	52.5	38.4
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.00	192.50	.58	2.34	45.0	31.0	41.0	26.0
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	.....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N. J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transportation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 75-37. *k* Reinforced; spec. C 75-37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe. *o* Less 30%. *p* Less 53%. *r* Truck delivery. *s* Price quotations on delivered basis since Mar. 1940; current f.o.b. price $84 for 6 in. *t* $130 for 8 in. *t* Reinforced pipe prices since May, 1937; current plain pipe prices are: 12 in., 36c.; 24 in. $1.50.



The "Facts of Life" for wire rope users . . .

EVEN when you start with a good wire rope—such as American TIGER BRAND—treat it right if you want it to give all the life that is built into it.

In this handy 48-page booklet are the things every wire rope user should know about proper rope handling and care.

The easy-to-follow instructions and the practical suggestions it offers are based on the experience of thousands of rope users. They will help you avoid the common errors that shorten rope life and reduce operating efficiency.

Subjects covered include — correct handling of ropes, how and when to lubricate, attaching of clips and sockets, splicing, care of sheaves and drums, minimum safety factors and many other helpful hints that will show you how to keep your wire rope operating at maximum efficiency and for the longest possible time.

Right now, with seasoned operators few and far between, this handy guide to better rope performance is doubly valuable. This booklet is free. Send for as many copies as you need and get them into the hands of the right men.

Send for FREE WALL CHART, too

The ten vital rules of wire rope care and handling are graphically illustrated and briefly described in this attractive wall chart. Printed in colors, on a 15" x 21" heavy cardboard mount, it can be placed for ready reference wherever wire rope is being used. Acts as a constant reminder of good wire rope operating use and practice.

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
COLUMBIA STEEL COMPANY
San Francisco
United States Steel Export Company, New York

USS

UNITED STATES STEEL

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*								LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R2k	6x12 R2k	12x12 R2k	2x12 R2k	12x12 R2k	¼" / ¾"
Atlanta	$37.00	$37.00	$32.00	$31.00	$31.00	$34.50	$46.00	.....	.....	$54.00	$64.00	$17.90 / $21.85
Baltimore	42.00	45.00	42.00	42.00	43.00	48.00	65.00	.....	.....	115.00	120.00	18.25 / 22.25
	48.00	*48.00*	*55.00*	*55.00*	*55.00*	*55.00*	*68.00*	*$70.00*	*$70.00*	.....	.....	..... / .....
Birmingham	45 00	45.00	44.50	43.50	44.50	47.50	68.00	63.00	67.00	.....	.....	17.35 / 21.15
[1]	50 00	50.00	49 50	48 50	49.50	52.50	72.00	.....	.....	67.50	70.00	..... / .....
Boston ‡*	42.00[3]	45.00[3]	55.00	60.00[3]	60.00[3]	65.00[3]	68 00[3]	.....	.....	72.00[3]	72.00	18.25 / 22.25
‡*	*50.00*	*50.00*	*58.00*	*60.00*	*65.00*	*65.00*	*72.00*	*72.00*	*72.00*	.....	.....	..... / .....
Chicago	54.00	54.00	55.00	54.00	54.00	60 00	68.00	.....	.....	80.00[l]	95.00[l]	14.60 / 17.80
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*55.00*	*66.00*	*66.00*	*67.00*	.....	.....	..... / .....
Cincinnati	47.50	49.00	42.50	42.50	42.50	44.50	67.00	.....	.....	65.00	65.00	17.35 / 21.15
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..... / .....
Cleveland	42.50[k]	42.50[k]	52.50[k]	51.00[k]	65.00	65.00	83.00	83.00	83.00	.....	.....	17.75 / 21.60
Dallas *e*	45.25	45.25	44 50	43 00	43.00	47.25	60.75	58.75	58.75	88.75	85.00	14.60 / 17.80
Denver ‡	63.50[3]	62.00[3]	65.00[3]	65.00[3]	65.00[3]	66.00[3]	69.00[4]	*83.00*	*89.00*	.....	.....	10.45 / 12.70
Detroit	61.00	61.00	57.75	57.75	57.75	62.75	72.75	75.00	90.00	70.75	90.00	17.35 / 21.15
	57.00	*57.00*	*57.00*	*57.00*	*62.75*	*63.75*	*71.00*	*75.00*	*75.00*	.....	.....	..... / .....
Kansas City *a*	69.00	69.00	67.00	65.50	67.00	69.00	84.00	.....	.....	84.00	94.00	12.60 / 15.40
	66.00	*66.00*	*59 50*	*59.50*	*59.50*	*59.50*	*75.00*	*80.00*	*80.00*	.....	.....	..... / .....
Los Angeles *a*	60.00	60.00	60.50	60.75	59.25	59.25	72.75	72.00	72.00	.....	.....	9.90*gh* / 12.05*gh*
Minneapolis ‡*b*	59.00[3]	59.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60 / 15.40
‡	*56.50*	*64.75*	*57 00*	*57 25*	*56.25*	*57.00*	*61.50*	*59.75*	*59.75*	.....	.....	..... / .....
Montreal †[7]	*58.00*	*61.00*	*54.00*	*58.00*	*60.00*	*66.00*	.....	.....	.....	220.00	220.00	..... / .....
	54.00	*54.00*	*57.00*	*57 00*	*57.00*	*58.75*	*62.00*	*62.00*	*62.00*	.....	.....	..... / .....
New Orleans	40.00	40.00	37.00	35.00	34.00	36.00	46.00	.....	.....	55.00	69.00	14.60 / 17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	..... / .....
New York	67.50	67.50	62.50	62.50	62.50	64.00	74.00	.....	.....	120.00*f*	125.00*f*	18.35 / 22.25
‡	.....	.....	*65.00[3]*	*65.00[3]*	*65.00[3]*	*65.00[3]*	[Range from $75 to $95]			.....	.....	..... / .....
Philadelphia	65.00	70.00	70.00	70.00	70.00	70.00	75.00	.....	.....	130.00	130.00	18.25 / 22.25
	70.00	*75.00*	*70.00*	*70.00*	*70.00*	*70.00*	*85.00*	*90.00*	*90.00*	.....	.....	..... / .....
Pittsburgh	50.80	53.20	62.75	55.00	60.85	62.50	76.25	.....	.....	.....	.....	18.10 / 22.05
	69.20	*68.10*	*68.10*	*65.30*	*65.20*	*66.65*	*88.75*	*88.75*	*88.75*	.....	.....	..... / .....
St. Louis ‡*c*	59.00	59.00	56.00	55.00	56.00	57.00	69.00	*75.00*	*75.00*	88.00	87.00	14.60 / 17.80
San Francisco *d*	*41.00*	*41.00*	*36.50*	*36.75*	*35.75*	*35.75*	*37.50*	*36.00*	*35.00*	.....	.....	7.30*g* / 8.90*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00 / 0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf [2] Roofers' N. C. Pine. [3] Spruce. [4] Native [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $95.15; on ¾", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum *i* Ranges from $65 to $69. *j* Average price. *k* August 1943 price. *l* September price; none later available.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness — A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
Atlanta	75%	75%	$0.15
Baltimore	78%	79%	.15
Birmingham	76%	76%	.105
Boston	77%	78%	.15
Chicago	77%	77%	.15
Cincinnati	77–10%	77–10%	.15
Cleveland	77–10%	77–10%	.19
Dallas	76%	76%	.1625
Denver	76%	76%	.155*e*
Detroit	77%	77%	.1575
Kansas City	77–10%	77–10%	155
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	77%	77%	.155
Montreal	40–10–5*ab*	40–10–10*ac*	.1675†
New Orleans	70%	75%	.16
New York	81%	82%	22*f*
Philadelphia	78%	79%	.15
Pittsburgh	79%	79%	1225
St. Louis	77–10%	77–10%	155
San Francisco	66%	73%	155
Seattle	75%	75%	1575†

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	...
12-in.—2-ft. from butt	6-in.	50 to 59-ft.	.35	...
12-in.—2-ft. from butt	6-in.	60 to 69-ft.	.36	...
12-in.—2-ft. from butt	6-in.	90 to 100-ft.	....	.515
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.5825
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	.62
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.43	.59
14-in.—2-ft. from butt	5-in.	80 to 85-ft.	.53	...
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	.56	....
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.61

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25*a*
Chicago	Red Oak	....	2.00/2.25*a*	2.87	3.00*a*
Los Angeles	Douglas Fir	2.00	3.25*a*	2.90	4.70*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.48	....	2.04	....
	Red Oak	1.48	2.05*a*	2.04	2.83*a*
	Sap Pine or Cypress	1.55	....	1.91	....
San Francisco	Douglas Fir	1.25*bef*	....	....	3.00*eg*
Montreal	Birch or Maple	.85	.95	....†	....†

Tr.—Treated; Untr.—Untreated. *a* Creosoted *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50– 2.10
Chlorine cylinders, liquid, per lb. delivered	.0325
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.00

Now! JENKINS VALVES OF AIR FURNACE MALLEABLE IRON

Fig. 1101
Inside Screw
Bronze
Mounted
Gate

Battle-Tested for Toughness

Jenkins Air Furnace Malleable Iron Valves were developed for some of the most strenuous war services — to withstand severe strains, heavy blows, even the shock of nearby explosions. They are made from the same tough metal that has been battle-proved daily in U. S. war equipment.

Now available for industry, they compare favorably with carbon steel in strength and impact-resistance, yet they are priced substantially less. They save also by protecting the user against costly valve breakage and service interruptions.

Next time you order valves for use where steam pressure does not exceed 150 pounds, and temperature is not above 450° F., check service conditions closely. If the valves will be subject to destructive shocks and strains, and if corrosive conditions are bad, consider Jenkins Air Furnace Malleable Iron Valves. There's a good chance they'll serve best and save most.

Get Bulletin No. 192 on this complete new line of Jenkins Valves, in patterns illustrated here, sizes 2 in. to 6 in. Jenkins Bros., 80 White Street, New York 13.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros. Ltd., Montreal; London.

Fig. 1107
Bronze Mounted Angle

Fig. 1105 Bronze Mounted Globe

Fig. 1109 Bronze Mounted Swing Check

COMPARE	TENSILE STRENGTH	SHOCK RESISTANCE		TEMP-ERATURE LIMIT	CORROSION RESISTANCE Relative	VALVE COST (Relative)
		YIELD POINT	ELONGATION IN 2 INCHES			
ASTM 126-30 CAST IRON		0	0			
ASTM 47-33 AIR FURN. MALL. GRADE 35018			10%			
ASTM 95-36 CARBON STEEL			22%			

ONLY AIR FURNACE MALLEABLE MEASURES UP TO THESE PROPERTIES

Don't confuse *Air Furnace* Malleable with other types of malleable iron. Top-rated grade is Air Furnace Standard Specification ASTM-47-33, Grade No. 35018 . . . the type used by Jenkins!

MEETS U. S. STANDARDS – Air Furnace Malleable Iron Valves meet standards of U. S. Maritime Commission, and Bureau of Marine Inspection and Navigation, U. S. Coast Guard.

HIGH CORROSION RESISTANCE – Air Furnace Malleable Iron Valves resist corrosion better than carbon steel or cast iron valves. This advantage, combined with high impact resistance, recommends these new valves for marine, petroleum, mining, and various chemical and other industrial services.

JENKINS VALVES

SINCE 1864

For every industrial, engineering, marine, plumbing-heating service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

TRADE JENKINS MARK

Jenkins Bros

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED, Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED, Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK, Per M. in quantity. Common backing	Straight hard	LIME, Per ton, Hydrated finishing	In paper, Common hydrated	Carload lots, Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	300.00	15.90*k*	19.00*k*	18.00	13.00	2.30*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25*m*
Boston	96.30*a*	102.80*a*	192.70*a*	218.30	283.00	323.40	20.20*i*	20.20*i*	17.50†	12.50†	14.92*m*
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	22.00	22.00	15.50	13.00	.....
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	3.30*m*
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	15.00
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	18.00	25.00*j*	17.00*j*	20.00*m*
Detroit	92.70	96.70	181.20	206.75	267.50	306.00	20.00	21.00	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	14.50	16.50	19.32	13.00	10.92
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.00*b*	86.40*b*	159.90*b*	.....	177.00*b*	246.00*b*	13.60	15.60*g*	21.00	16.00	19.00
Montreal	94.55*a*	100.45*a*	199.50*a*	160.45*a*	109.40*at*	137.40*av*	21.08†*u*	28.35†*u*	24.60*u*	18.00*u*	.....
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	17.00/18.00	.....	20.00	14.00	17.00
Philadelphia	85.30	91.00	170.50	204.50	252.00	312.00	17.00	20.00	19.00	16.00	15.00
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.50*m*
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	2.30*m*
San Francisco	96.00	108.00	144.00	.....	.....	.....	19.00	.....	24.00	23.00	2.80*m*
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00*f*	21.00*f*	20.00*a*	20.00*a*	20.00*a*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days cash. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* 2% discount 10 days. *t* 5½x8x12. *u* 8% sales tax included. *v* 6x12x12-in. *w* Per 220 lb. bag.

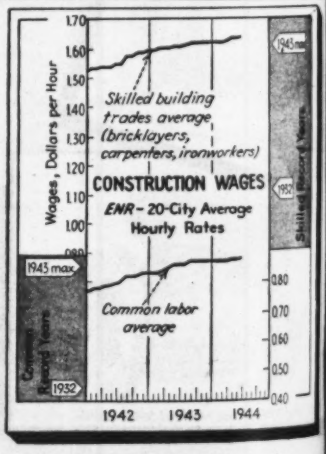
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD, Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD, Per 100 lb. in oil	READY-MIXED PAINT, Per gal., drums, Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES, Carload lots f.o.b. factory, Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	1.65	2.50	2.30	2.00‡*h*	2.00‡*u*	2.00‡*u*	.50‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*h*/*f*	1.74*h*/*f*	1.82*h*/*f*	.33/*f*	23.00/*f*
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.93	1.83*h*	1.83*h*	.35	29.00
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
Denver	10.50	14.25	....	....	.27*l*	2.45	2.95	2.95	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*g*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*h*/*i*	1.66*h*/*i*	.32	23.00
Montreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	4.02*t*	2.58*t*	3.01*t*	.89*t*	2.10*w*
New York	10.00	13.75	2.03	....*r*	1.82	1.66	1.58*h*	1.58*h*	.26	25.00
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.66	1.66	1.66	.28	23.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	26.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted special. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor, Building	Common Labor, Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.825	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.875*e*	1.575	1.875	1.875	1.875	1.085	1.15/1.25
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65*b*	1.50*b*	1.50*b*	1.50/1.625*b*	1.50*b*/*f*	.80*b*	.80*b*
Detroit	1.725	1.50	1.75	1.675/1.75	1.725	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.625	1.44	1.625	1.50	1.625*e*	.95	.95
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.10/*f*	.95
Philadelphia	2.00	1.58	2.00	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	1.00	1.00
Seattle	1.845	1.565	1.745	2.00	1.865	1.145	1.10
Montreal*	1.05	.95	1.00	.90	1.00	.60	.65



b 7 hr. day. *c* Prevailing rate on government work. *e* 35 hr. wk. * Cost of living bonus now included in basic wage.

ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers) $1.638
ENR Common Average; $0.877

4 MOTO-CRANES

TEAM-UP TO ERECT LONGEST WOOD ROOF TRUSSES EVER BUILT

SING 4 Moto-Cranes to raise thirty-one 200 ft. wood roof trusses on the new n Aeronautical Final Assembly Building an Diego, is a liftable idea submitted by Hazard & Sons, owners of 12 Lorains.

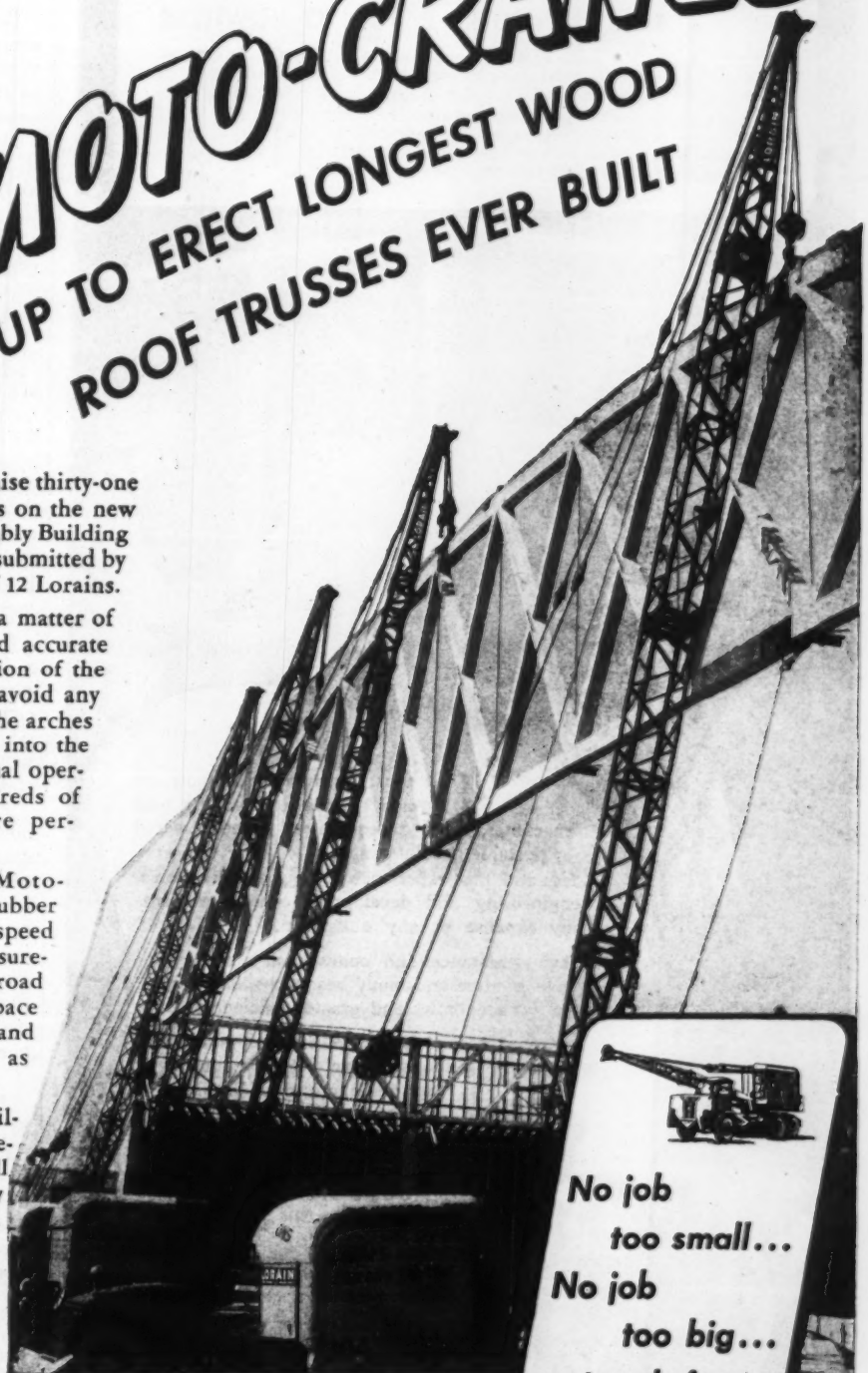
his job was not so much a matter of ght as one of mobility and accurate m control. Equal distribution of the had to be maintained to avoid any ortion or mistreatment of the arches le maneuvering each truss into the plate positions—an unusual oper-n, yet typical of the hundreds of ied jobs Moto-Cranes are per-ning daily.

ompletely mechanized, Moto-nes are mounted on 10 rubber s that cushion as well as speed ir travel between jobs—are sure-ted and steady on off-the-road s, crawl along at a snail's pace speed up to 35 M.P.H., and key into working position as ily as parking your car.

f mobility and maneuverabil-are essential on your mate-handling operations, you'll it mighty profitable to apply to-Crane performance on r postwar jobs. See your ain distributor for details.

THEW SHOVEL COMPANY
LORAIN, OHIO

Ryan Aeronautical Company Photo



No job too small... No job too big... or tough, for a MOTO-CRANE

Reg. Trade Mark

thew-Lorain

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lots Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	300.00	15.90k	19.00k	18.00	13.00	2.30m
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25m
Boston	96.30a	102.80a	192.70a	218.30	283.00	323.40	20.20i	20.20i	17.50†	12.50†	14.92†
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.30
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	22.00	22.00	15.50	13.00	.....
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75j	13.25j	3.30m
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50i	15.00i	19.00	15.00	15.00
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	18.00	25.00j	17.00j	20.00j
Detroit	92.70	96.70	181.20	206.75	267.50	306.00	20.00	21.00	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00c	128.00	163.00	189.00	14.50	16.50	19.32	13.00	10.92
Los Angeles	73.50†r	89.50†r	128.00†r	210.00†r	368.00†r	460.00†r	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.00b	86.40b	159.90b	.....	177.00b	246.00b	13.60	15.60g	21.00	16.00	19.00
Montreal	94.55a	100.45a	199.50a	160.48a	109.40at	137.40av	21.08†u	28.35†u	24.60u	18.00u	.....
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00c	193.30k	238.80k	295.60k	17.00/18.00	.....	20.00	14.00	17.00
Philadelphia	85.30	91.00	170.50	204.60	252.00	312.00	17.00	20.00	19.00	16.00	15.00
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.35m
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	2.50m
San Francisco	96.00	108.00	144.00	.....	.....	.....	19.00	.....	24.00	23.00	2.50m
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00f	21.00f	20.00s	20.00s	20.00s

† F.o.b. a Smooth. b Carload lots delivered to job. c 6x12x12 in. d Not load bearing. e 48 lb. tile. f Less $1.00, ½ cash 15 days, balance 30 days g Selected common. h F.o.b. Perth Amboy, N. J. i F.o.b. Warehouse only. j LCL k $1.00 discount if paid in 10 days. l Lump. m Per bbl., 180 lb. o Per bbl., 200 lb. p 280 lb. bag. r 5% discount 10 days. s 2% discount cash. t 5½x8x12. u 8% sales tax included. v 6x12x12-in. w Per 220 lb. b

PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry a	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite b	Aluminum b	Ferric Oxide d	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50r	1.98r	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	1.65	2.50	2.30	2.00‡h	2.00‡u	2.00‡u	.50‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75h/	1.74h/	1.82h/	.33/	23.00/
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39h	2.39h	.36	21.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.93	1.83h	1.83h	.35	29.00
Dallas	10.00	14.50	1.88	2.11n	.05l	1.75h	1.66h	1.66h	.35	39.00
Denver	10.50	14.25	....	....	.27l	2.45	2.95	2.95	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.39g	2.55gr	2.16g	2.10	2.30	2.30	.28	27.00
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75i	1.66hi	1.66hi	.32	23.00
Montreal	9.25	6.25	2.50p	4.90p	3.15p	4.02i	2.58i	3.01i	.80i	a ton
New York	10.00	13.75								
Philadelphia	10.00	13.75								
Pittsburgh	10.00	13.75								
St. Louis	10.00	13.75								
San Francisco	10.25	14.00								
Seattle	10.25	14.25								

‡ Delivered. Note: Red lead in oil 50c. higher than lead prices change frequently due to pig lead price chan Spec. 3-49A. c ASTM Spec. D266-31. d 80% minimu e Subject to 25% discount. f Distributors' price to co

SKILLED AND

	Bricklayers	Carpenters	Struct. Iron Workers
Atlanta	$1.50	$1.25	$1.50
Baltimore	1.75	1.375	1.60
Birmingham	1.75	1.25	1.50
Boston	1.625	1.50	1.65
Chicago	1.75	1.70	1.76
Cincinnati	1.825	1.50	1.675
Cleveland	1.875c	1.575	1.675
Dallas	1.625	1.25	1.50
Denver	1.65b	1.50b	1.50b
Detroit	1.725	1.50	1.75
Kansas City	1.65	1.50	1.625
Los Angeles	1.50	1.35	1.625
Minneapolis	1.625	1.44	1.625
New Orleans	1.50	1.25	1.50
New York	2.00b	1.85b	2.00
Philadelphia	2.00	1.58	2.00
Pittsburgh	1.90	1.75	1.75
St. Louis	1.75	1.50	1.75
San Francisco	1.875	1.50	1.75
Seattle	1.845	1.565	1.745
Montreal*	1.05	.95	1.00

b 7 hr. day. c Prevailing rate on government work. * Cost of living bonus now included in basic wage.

TIGH

BOU

4 MOTO-CRANES

TEAM-UP TO ERECT LONGEST WOOD ROOF TRUSSES EVER BUILT

SING 4 Moto-Cranes to raise thirty-one 200 ft. wood roof trusses on the new n Aeronautical Final Assembly Building n Diego, is a liftable idea submitted by Hazard & Sons, owners of 12 Lorains.

his job was not so much a matter of ght as one of mobility and accurate m control. Equal distribution of the had to be maintained to avoid any ortion or mistreatment of the arches le maneuvering each truss into the plate positions—an unusual oper-n, yet typical of the hundreds of ed jobs Moto-Cranes are per-ming daily.

· MOTO-CRANES

HTLY

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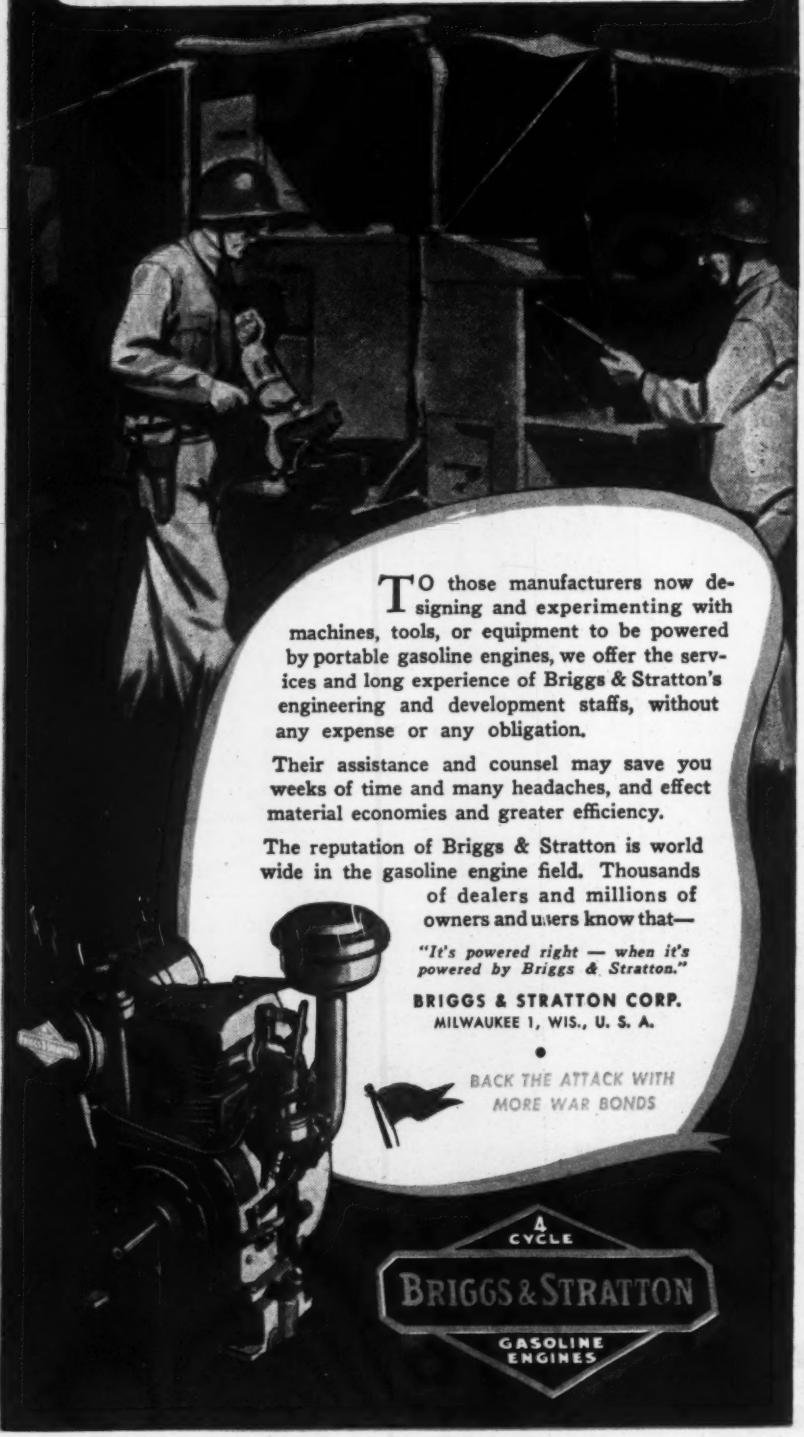
A Mobile Service...

FOR ANY GUN — PISTOL TO HOWITZER

"Keep 'em Firing"—no matter where they are. That's the slogan. Repair crews, with their mobile workshops, service all types of guns, from pistols to howitzers. Generating units, powered by gasoline engines, charge batteries and operate electric drills and other modern tools. This is typical of the multitude of vital jobs — both standard and special — for hundreds of thousands of rugged, dependable Briggs & Stratton engines "in the service."



TO those manufacturers now designing and experimenting with machines, tools, or equipment to be powered by portable gasoline engines, we offer the services and long experience of Briggs & Stratton's engineering and development staffs, without any expense or any obligation.

Their assistance and counsel may save you weeks of time and many headaches, and effect material economies and greater efficiency.

The reputation of Briggs & Stratton is world wide in the gasoline engine field. Thousands of dealers and millions of owners and users know that—

"It's powered right — when it's powered by Briggs & Stratton."

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BACK THE ATTACK WITH MORE WAR BONDS

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

BRIEF NEWS

Replacement of inadequate high with high speed roadways along se of the Pacific Highway in Oregon be started this year under a $2.5 federal-state construction progra dorsed recently by the Oregon Highway Commission. Principal b necks to be eliminated are those i Steiwer-Hill-Albany, Halsey-Harri and Graves Creek sections. Sinc project involves a strategic hig little difficulty in obtaining a rele materials by the WPB is anticip

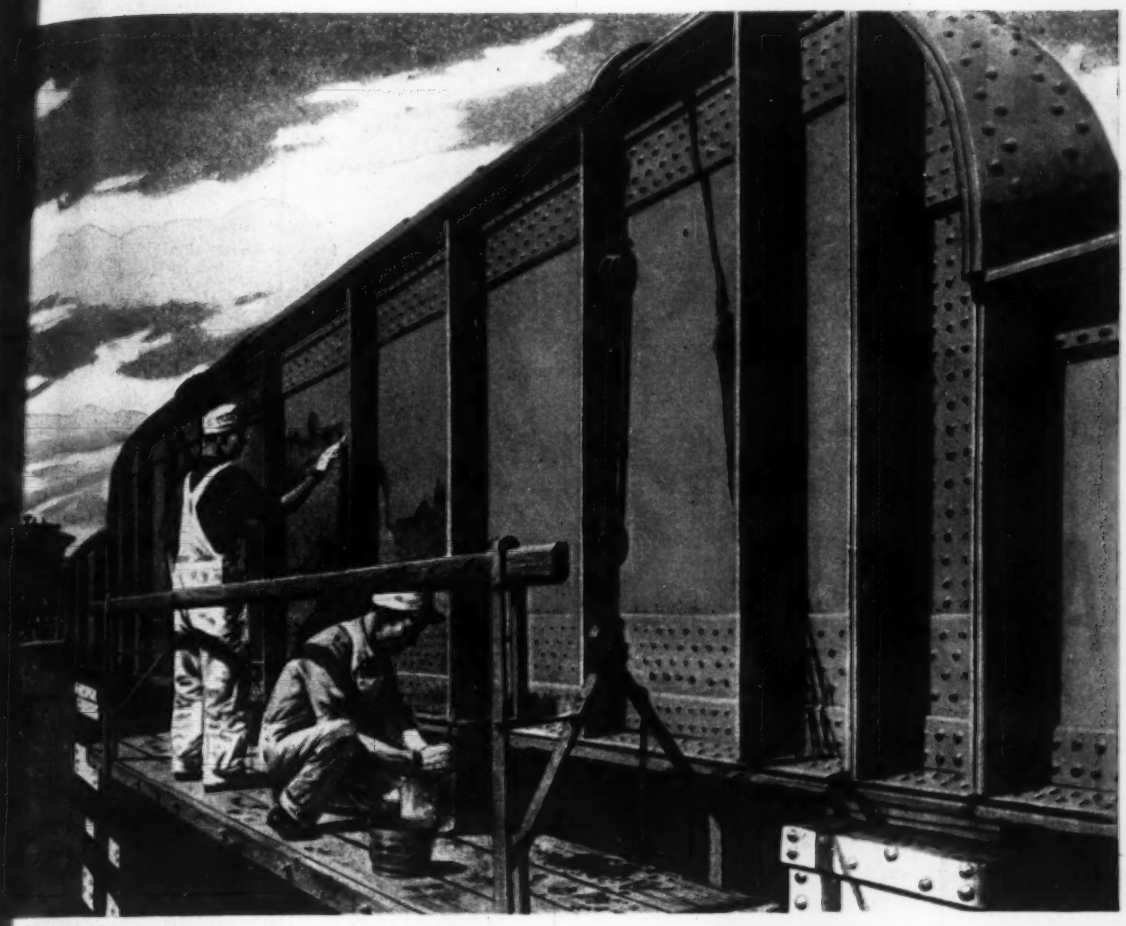
A Thames Valley Flood Control ect Commission is being set up b nicipalities in the valley of the Th River, in southwestern Ontario. Ap ments to the commission have been by some of the municipalities. Thames River is subject to floods spring, and much damage has done, notably in the city of Lo Dams and other regulating works part of the program.

A law has been passed in Kent providing that a constitutional am ment be submitted for a vote, to hibit diversion of any state highway partment funds for use of any state department.

Funds in the State Highway De ment for building and keeping up r come entirely from motor vehicle censes, and from a 5 cent per gallon on gasoline. Efforts to change the to turn over part of the proceeds cities and counties have been bea There have also been unsuccessful forts to legalize the use of highway partment funds for educational p poses or for other state departments

Recommendation that the propo $424,305 trunkline sewer for San Die Calif., be approved for federal fi has been made by the San Diego p duction urgency committee. It would part of the city's sewer improvem program for which bonds were voted 1941.

A recent change in conservation o der M-9-c-4 of the War Productio Board permits the use of copper a copper base alloy pipe and tubing the construction of water and gas ser ices. The revision of the WPB ha ing utilities standards provides that use of such pipe and tubing in m housing must be confined to the amo required to reach from the main to curb stop or to the consumer's pro erty line. The revised standards p



HELPING UNCLE SAM KEEP HIS BRIDGES UP

nd highway bridges—links in the
ortation chain carrying vital war-
raffic—must be kept up. They can
otected, can be *made to LAST*—
Dutch Boy Red Lead.

e has recorded that there is no
effective rust preventive paint for
s, ships, tanks and other metal
ures.

ch Boy Red Lead provides a smooth,

THIS PHOTOMICROGRAPH of red lead soap formations shows how they intertwine chanically reinforce the paint film. also characteristic of "lead soaps" that low movement all along their intermeshing ions. This is beneficial to the life of the , once the elastic limit of the dried oil film e soap particles is exceeded, the soap par- ill still "give" in this manner. This action s the ruptures to which a hard, unyielding m is subject.

tough, protective film that clings tight, and is extra-resistant to weather, smoke, dampness, salt water, sulfurous gases and other enemies of metal longevity.

The photomicrograph at the left shows an important factor contributing to the toughness, elasticity and adhesion of red lead paint films... the formation of intertwining "lead soap" structures.

Another great factor in red lead's performance is its ability to inhibit rusting of metal. The report at the right will be interesting in this connection.

You can obtain Dutch Boy Red Lead as a special *quick-drying* paint, in addition to the standard paste and paint forms. The quick-drying form is invaluable where drying time must be held to a minimum. It dries tack-free in 4 to 6 hours and may be recoated the next day.

A FREE copy of the illustrated booklet, "Longer Life with Red Lead," is ready for you at our nearest branch office. Write for it today!

IN A RECENT TEST of red lead's inhibitiveness, reported by Dr. A. H. Stuart in "Paint Manufacture" (Vol. IX, No. 1), a steel rod was immersed in a thin paste of red lead and water for one hour. The rod was then removed, thoroughly washed to remove all pigment, and tested along with an untreated rod. The treated rod, although all trace of red lead had been removed, showed decidedly greater resistance to rusting, as measured electrically, than did the untreated rod.

The above graph shows results of the test. In the electrical potential measurement method used, a lower point on the scale indicates greater resistance to rusting. Incidentally, the protective action, while it steadily diminished, had not entirely disappeared after forty hours.

* * *

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10; Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.).

DUTCH BOY RED LEAD

—makes metal LAST!

CLEAN AS A HOUND'S TOOTH!

The sharp clean lead, the sharp clean drawing, the sharp clean blueprint. Eldorado pencils make Eldorado drawings for Eldorado blueprints. That's the formula that sings the praise of Dixon's Typhonite Eldorado pencils.

What drawing pencil are *you* using? If it isn't stamped "Dixon's Typhonite Eldorado" there's a revelation coming to you in the sample we'll be glad to send. Write and request it!

TYPHONITE
ELDORADO

PENCIL SALES DEPT. 227-J6
JOSEPH DIXON CRUCIBLE CO., JERSEY CITY 3, N. J.

vide that only copper or copper alloy tubing available from the tory of a "producer" as defined ties order U-1 may be used means that (for the construction utilities' facilities authorized t new housing) no utility may per or copper base alloy pipe or purchased from any person oth another utility.

It will be several months actual work can begin on th Tennessee-Arkansas bridge at phis, according to W. W. M state highway director for Ar Washington has approved the p

Engineers working on prel designs will be delayed becaus recent flood. More investigation be made as to suitable locatio plans for foundations. The en ing firm of Modjeski & Masters risburg, Pa., has the preliminar tract and is presenting designs War Department for approval.

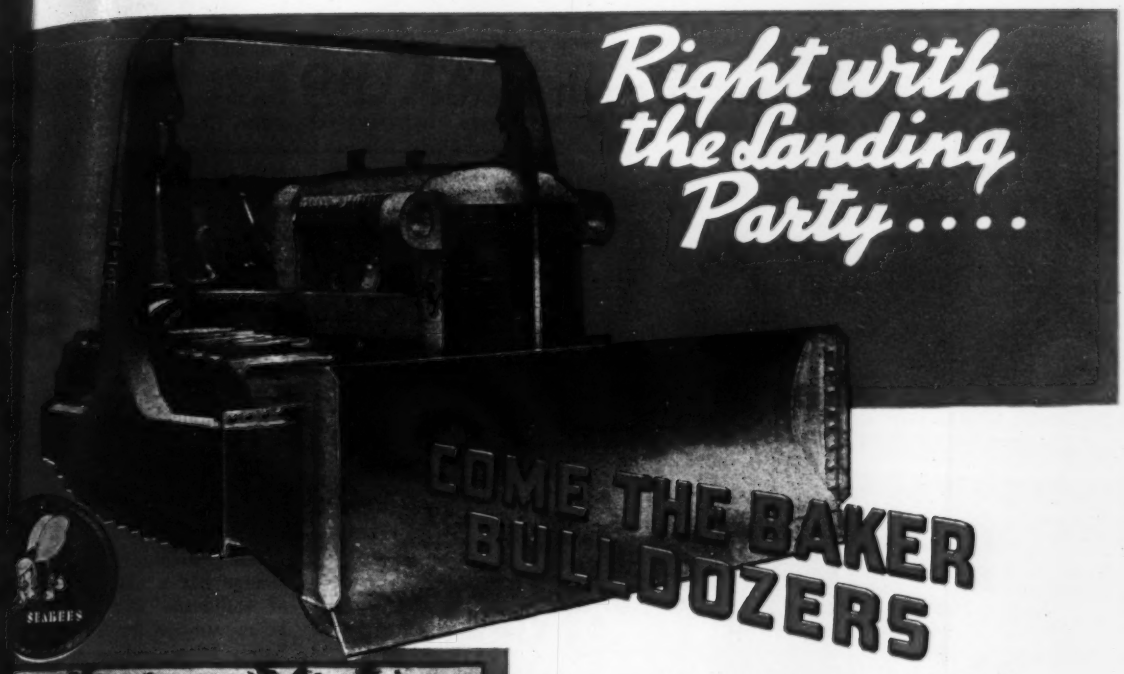
Recommendation that the Cal legislature appropriate $25,000,0 cover both state and local assess in the $820,000,000 flood contr gram for California now before gress was made recently by a joint legislative committee on water lems. Governor Earl Warren has asked to permit consideration state allocation at a special s of legislature.

The committee also went on r endorsing all projects proposed i Federal bill and favored another now pending before Congress would remove the 160-ac. limi farms which may receive water the Central Valley Project.

Employment of an engineer as a time airport construction and m nance assistant to Milton M. Ka president of the St. Louis board of lic service and chairman of municipal airport commission, has recommended by the commission. is in line with a recent suggestion a civil engineer be employed in sey's office to devote his entire to the development of a comprehe system of airport facilities for th Louis area.

Assurance of the War Manp Commission that labor will be a able for completion of the $8,400 Deschutes irrigation system in Or preluded the storing of water in partially constructed Wickiup r voir on the Upper Deschutes riv anticipation of reclaiming 20,000 a of land in 1945. About 15,000 a of water, which will have been pounded soon will be moved nearly

Right with the Landing Party....



Bulldozer on Allis-Chalmers tractor spreading, leveling surfacing road on jetty for extending supply object South Pacific.

Bulldozer spreads material for another type of jetty to facilitate landing of barges.

Bulldozers are not fighting equipment. They pack no artillery—they have no protecting armor plate. They don't even enjoy pet names like "Lulu Belle" or "Memphis Mamma," but they are in there—pitching!

Baker Bulldozers are doing all right backing up the Yanks in every theater of war. You will find them right behind the fighting men — filling shell holes—leveling cratered air fields—excavating for underground oil tanks and ammunition dumps—building landing docks—digging drains and fox-holes—making themselves useful to the fighting men. Their aid in consolidating positions on beach heads, mountain sides or sand dunes is hard to over-estimate.

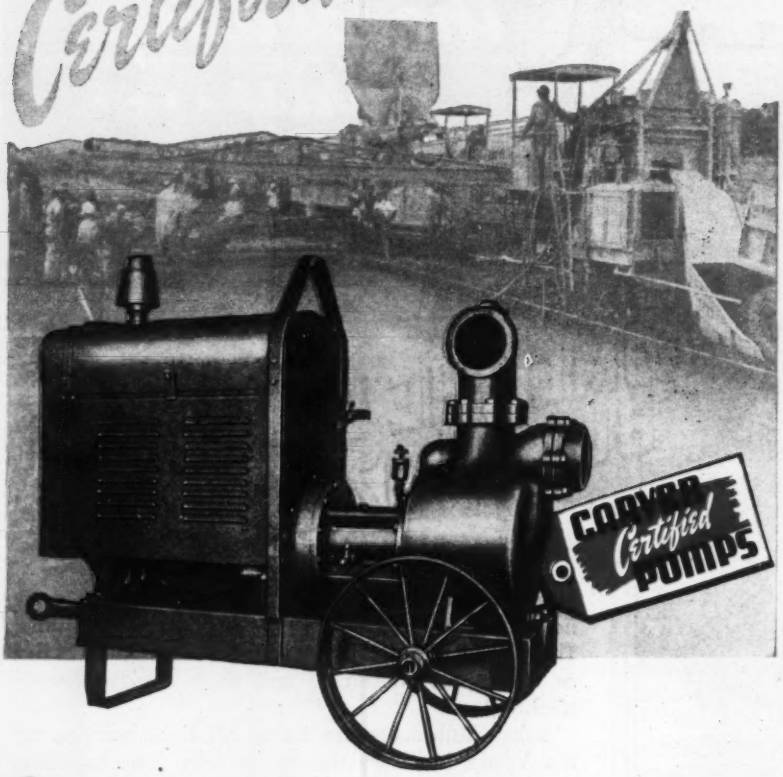
Commanders of task forces have learned that it is almost as important to have bulldozers as tanks in the holds of their LST ships. Bulldozers have won their spurs and Baker Bulldozers, because of their fast, positive hydraulic control, dependability and rugged design stand high on the honor roll.

It's true that supporting our fighting forces is a full time job for Baker Bulldozers *NOW*. But just as soon as our enemies are vanquished, you will find the Baker ready to perform equally notable feats on your contracts. Send for a copy of "Unsung Heroes of War."

THE BAKER MFG. CO.
567 Stanford Ave.
SPRINGFIELD, ILL.

ULLDOZERS SNOW PLOWS **BAKER** CONSTRUCTION EQUIPMENT

Certified means each tested...

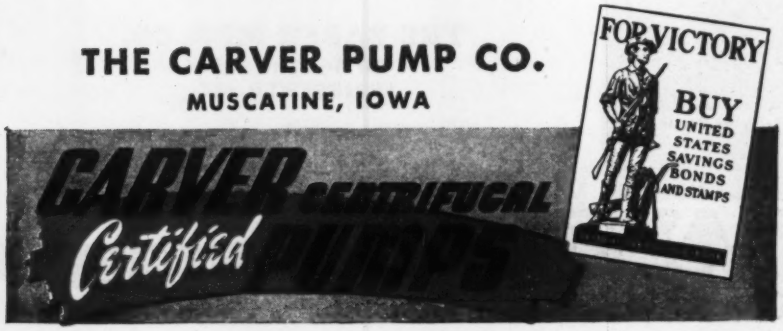


Carver...the Road Contractor's Pump

• The Carver "Certified" Tag on every Carver pump means that each pump has passed a stiff performance test in our modern laboratory. No pump gets a tag until we know that it will perform satisfactorily.

Carver laboratory testing guarantees immediate performance when you put a pump to work. Carver on-the-job testing assures continuous performance with trouble-free service. Get more information about this pump tested in the laboratory and proved on actual jobs. Write today. No obligation, of course.

THE CARVER PUMP CO.
MUSCATINE, IOWA



miles through the Deschutes riv
nel and a canal. Work to be
pleted includes the boring of tw
nels through rock pinnacles and
across Crooked river to carry a

District Judge John J. Hallo
Des Moines, Ia., recently revers
industrial commissioner's ruling
the widow of an Iowan employe
construction company in Oklaho
entitled to workmen's compens
The widow had been awarded
plus $15 a week for 300 weeks
$150 funeral expenses. The
Construction Co., Des Moines, th
ployer, appealed. The judge fou
contract was not consummate
Iowa, that the work was perform
side Iowa, and that the state ind
commissioner was without jurisd

The Pittsburgh, Pa., Builder
change has a plan to create a
of standards and appeals wh
being studied by Mayor Scully
Safety Director George E. A. Fa
The board would consist of two
neers, two architects, two building
tractors and another person
mended by the National Board o
Underwriters.

A $1,500,000 car ferry termin
Milwaukee is being planned b
Pere Marquette railroad as soo
material is available, accordin
Harry Brockel, municipal port di
for Milwaukee. A site has already
purchased near the downtown
The project will include, besides
slips and docks, a depot for pass
traffic.

The North Carolina state plan
board, Collier Cobb Jr., chairman
decided to undertake an immedia
ventory of public works plans
all state and local governmental
It is believed that state administ
agencies can accomplish little u
local communities are ready to a
programs affecting their own de
ment.

Landslides along Brays Bayo
Houston, Tex., are endangering
city streets and homes. John G. T
public works director, estimates
000 will be needed to repair dam

Option to buy the Glacier Grave
which has an immense sand and
plant taking material from a hil
tween Steilacoom and Titlow
near Tacoma, Washington., was
recently by Henry J. Kaiser. Off
of the Glacier Co. in Seattle said
Kaiser is interested in the proper
a cement operation.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

HIGHWAY AND BRIDGE, VIRGINIA

OWNER: Department of Highways, Commonwealth of Virginia.

PROJECT: Paving 1.502 miles of Route 1 in Arlington County, Va., with reinforced cement concrete pavement and bituminous concrete pavement. Also widening bridge over Four Mile Run near Alexandria. Project begins at north city line of Alexandria and extends northward. Bridge, at Sta. 99+65, requires two 20-ft. concrete slab spans. Bridge roadway width 42-ft., length 47½-ft.; one sidewalk of 5-ft. width.

CONDITIONS: Contractor to furnish all materials and complete work in 120 calendar days. Rail and highway transportation facilities available. Prevailing wage rates to be paid.

BIDS: Four bids were received May 2, 1944, ranging from the contract low $281,206 to $312,874.

LIST OF BIDDERS:

1. W. H. Armstrong & Co., Washington, D. C. (contract) $281,206
2. Corson & Gruman Co., Washington, D. C. 288,230
3. E. W. Hechler, Contractor, Richmond, Va. 301,626
4. B. W. Jackson Cont'g. Co., Richmond, Va. 312,874

Roadway

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Regular excavation	5,586 c. y.	$0.40	$0.60	$0.60
2. Borrow excavation	34,181 c. y.	.60	.80	.95
3. Concrete, Class A	33 c. y.	50.00	42.00	45.00
4. Concrete, Class C	22 c. y.	45.00	35.00	30.00
5. Metal reinforcement	3,299 lb.	.07	.08	.065
6. Pipe underdrains, 6-in.	1,160 l. f.	.90	.90	.85
7. 15-in. concrete pipe	369 l. f.	2.75	3.00	2.50
8. 18-in. pipe	66 l. f.	3.25	3.20	2.80
9. 24-in. pipe	69 l. f.	6.25	4.80	4.50
10. 36-in. pipe	1,623 l. f.	7.00	7.00	7.00
11. 6-in. pipe (concrete)	69 l. f.	.60	1.50	.85
12. 12-in. pipe (concrete)	18 l. f.	2.50	3.00	2.00
13. Tee joints (36" tee, 15" butt)	3 ea.	30.00	40.00	45.00
14. Tee joint (36" tee, 18" butt)	1 ea.	30.00	40.00	45.00
15. 6-in., 90-deg. ell joint	1 ea.	1.00	3.00	5.00
16. Pipe (relaid)	86 l. f.	2.00	4.50	2.25
17. Manhole (special design)	1 ea.	400.00	360.00	250.00
18. Curb drop inlets (complete)	11 ea.	100.00	75.00	100.00
19. Curb catchbasins	9 ea.	125.00	80.00	150.00
20. Subgrade material (6-in. stab. grav. base)	4,283 c. y.	1.50	2.60	1.90
21. Subgrade material (patching)	517 c. y.	2.50	3.00	2.00
22. Plain combination cem. conc. curb. and gutter (6x14-in. curb, 2'8" gutter)	14,180 l. f.	1.50	1.65	1.60
23. Radial comb. cem. conc. curb. and (6x14" curb, 2'8" gutter)	224 l. f.	2.00	2.50	1.80
24. As above, 6x14"curb, 2'x'14'x8"gutter	47 l. f.	2.00	2.50	2.00
25. Rad. cem. conc. gutter (3½'x8")	12 l. f.	2.00	2.50	2.00
26. Plain cem. conc. gutter (2'x4")	11 l. f.	2.00	2.00	1.20
27. Rad. cem. conc. curb (6"x14")	616 l. f.	1.00	1.10	1.00
28. Plain cem. conc. curb (6"x18")	680 l. f.	1.00	1.15	.80
29. Cem. conc. entrance, 8-in. (HES)	1,708 s. y.	3.40	3.60	3.50
30. Remove concrete pavement	1,918 s. y.	.60	.40	.50
31. Concrete patching, 8-in. (HES)	3,100 s. y.	3.80	4.10	4.50
32. Reflect. advance warning signs	2 ea.	30.00	15.00	60.00
33. Remove and reset steel fence	1,262 l. f.	.60	1.50	1.20
34. Reset F. A. project marker	1 ea.	2.00	5.00	2.00
35. State project markers	2 ea.	4.00	5.00	5.00
36. Piling (untreated)	800 l. f.	2.00	2.00	1.50
37. Cement conc. sidewalk, 4-in.	3,196 s. y.	1.90	2.00	2.10
38. Barrier curb (7"x20")	1,400 l. f.	1.25	1.20	1.20
39. Concrete median strip (3'x6")	233 s. y.	4.00	3.00	2.80
40. Lumber (storm sewer mat)	6 Mbm.	150.00	80.00	120.00
41. Remove, reset wire fence	654 l. f.	.60	1.50	1.20
42. Stab. gravel base (entrance)	90 c. y.	2.50	4.00	2.50
43. Cement concrete, Class X (HES) (irreg.)	1,462 c. y.	11.50	12.00	12.50
44. Rein. cem. conc. pavement, 8-in.	27,554 s. y.	2.85	2.80	2.85
45. Hot bitum. conc. surf. course	3,261 ton	8.00	7.20	8.10
46. Hot bitum. conc. base course	4,241 ton	8.00	7.00	8.10
47. Hot bitum. conc. base crse. (irreg.)	416 ton	8.00	7.50	8.10

Bridge Widening

Item	Quant	Unit Prices (1)	(2)	(3)
1. Class A concrete	51.9 c. y.	$45.00	$62.00	$45.00
2. Reinforcing steel	6,120 lb.	.07	.08	.065
3. Hot bitum. conc. surface course	17.6 ton	8.00	8.00	8.10
4. Hot bitum. conc. base crse.	7.1 ton	8.00	8.00	8.10
5. Hot bitum. conc. base crse. (irreg.)	40 ton	8.00	7.50	8.10
6. Class A concrete (substructure)	4.5 c. y.	45.00	30.00	45.00
7. Class B concrete (substructure)	193 c. y.	40.00	24.00	40.00
8. Excavation, Type A (substructure)	31 c. y.	4.00	4.50	4.00
9. Excavation, Type B (substructure)	122 c. y.	25.00	20.00	25.00
10. Timber piles (untreated), substr.	2,100 l. f.	1.50	1.85	1.50

WATERMAINS, DALLAS, TEX.

OWNER: City of Dallas, Tex.

PROJECT: Construction of 6-in. to 24-in. cast iron watermains and appurtenances, and pump house modification and addition in connection with the extension of the Dallas, Tex., water supply system. (Contract 6.) Involves the furnishing and laying of cast iron watermains; necessary valves and fittings; concrete for structures; gravel backfilling; replacing brick, concrete, asphalt, and surface treated pavement; fire hydrants; railroad crossing; pump house modification and addition; and sanitary sewer crossing.

CONDITIONS: Contractor to furnish all material and complete work in 150 calendar days. Project includes salvaging of 1,815 feet of 6-in. cast iron pipe. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.50 to $1.62½ per hour; semi-skilled, $1.00; and common labor, 55c.

BIDS: Thirteen bids were received April 19, 1944, ranging from the low of $333,783 to $508,438.

LIST OF BIDDERS:

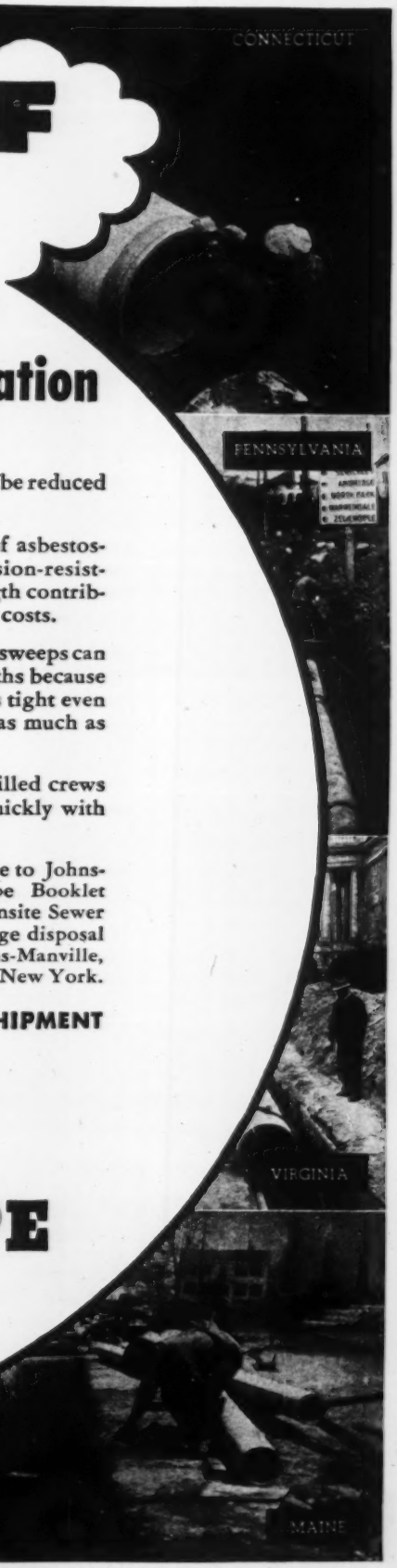
1. Fred Dellone Constr. Co., Dallas, Tex. (low bidder) $333,783
2. M. F. Fischer & Son, San Antonio, Tex. 340,613
3. Ben Sira & Co., Dallas, Tex. 342,927
4. P. C. Sorenson Co., Dallas, Tex. 345,246
5. Dalton & Cullum, Dallas, Tex. 358,066
6. E. H. Reeder Constr. Co., Dallas, Tex. 379,361
7. Williams & Whittle, Inc. 396,337
8. Sherman Machine & Iron Works, Oklahoma City, Okla. 399,060
9. Leland Fikes, Dallas, Tex. 406,065
10. B. & M. Constr. Co., Oklahoma City, Okla. 409,297
11. Claud Everett, Inc., Houston, Tex. 434,944
12. Ransdell Constr. Co., Pharis, Tex. 445,948
13. F. S. Oldt Co., Dallas, Tex. 508,438

Item	Quan.	Unit Prices (1)	(2)	(3)
1. 24-in. c. i. water main, Cl. 150 bds.	2,358 l. f.	$8.60	$8.51	$9.15
2. 20-in. c. i. water main, Cl. 150 bds.	9,774 l. f.	6.75	6.97	7.10
3. As above, Class 150 Mech. Joint	64 l. f.	8.00	7.34	6.50
4. 16-in. c. i. water main, Cl. 150 bds.	31,680 l. f.	5.20	5.65	5.55
5. As above, Class 150 Mech. Joint	176 l. f.	6.50	5.94	5.00
6. 12-in. c. i. water main, Cl. 150 bds.	896 l. f.	3.50	4.52	4.20
7. 10-in. c. i. water main, Cl. 150 bds.	12 l. f.	3.00	3.50	3.00
8. 8-in. c. i. water main, Cl. 150 bds.	36 l. f.	2.50	3.00	2.50
9. 6-in. c. i. water main, Cl. 150 bds.	360 l. f.	2.00	2.00	2.00
10. 4-in. c. i. water main, Cl. 150 bds.	12 l. f.	1.50	1.50	1.50
11. 24-in. gate valves	3 ea.	1,160.00	635.00	1,000.00
12. 20-in. gate valves	7 ea.	880.00	458.00	800.00
13. 16-in. gate valves	29 ea.	170.00	162.50	200.00
14. 12-in. gate valves	5 ea.	110.00	92.00	120.00
15. 10-in. gate valves	1 ea.	100.00	71.00	90.00
16. 8-in. gate valves	10 ea.	55.00	45.15	60.00
17. 6-in. gate valves	42 ea.	38.00	32.00	40.00
18. 4-in. gate valve	1 ea.	30.00	21.97	30.00
19. C. I. special fittings, 400-ft. W. P.	57.1 ton	178.00	250.00	200.00
20. Air relief valves	6 ea.	570.00	140.00	400.00
21. Blow-off manhole	1 ea.	500.00	102.00	400.00
22. Class A concrete	32.3 c. y.	35.00	28.00	40.00
23. Class C concrete	25 c. y.	10.00	18.00	20.00
24. Salvaging 6-in. c. i. pipe	1,815 l. f.	.50	.85	.25
25. Gravel backfill	20 c. y.	5.00	3.50	3.00
26. Replacing brick pavement	27 s. y.	5.00	4.65	4.00
27. Replacing concrete pavement	177 s. y.	4.00	2.80	2.50
28. Replacing asphalt pavement	4,299 s. y.	3.50	2.75	2.50
29. Replace surface treated pavement	8,164 s. y.	2.20	2.00	1.80
30. Fire hydrants	14 ea.	90.00	95.00	100.00
31. Gulf, Colo. & Santa Fe R. R. crossing	Lump Sum	1,600.00	882.00	1,600.00
32. Pump house modification, addition	Lump Sum	4,400.00	5,205.00	6,750.00
33. Sanitary sewer crossing	270 l. f.	8.00	1.60	2.00

OHIO
THOUSANDS
TRANSITE PIPE
CALIFORNIA
KANSAS
TEXAS
"Blueprint Now!"
ONE WAY to provide immediate jobs for our fighting men when they return—and at the same time permanently benefit our cities, towns and villages—is through the improvement and expansion of our water and sewerage systems. Such a program, to be effective, must be ready to put into operation as soon as wartime restrictions are lifted.
That means getting the planning done now. As an aid to post-war planners, the Committee on Water and Sewage Works Development has prepared a booklet entitled "Blueprint Now!" If you have not received a copy, one may be obtained by writing the Committee at Suite 2110, 500 Fifth Avenue, New York 18, New York.
NEW JERSEY
ARIZONA
NEVADA
MISSOURI
MICHIGAN

OF MILES OF

...are providing efficient, dependable, economical water transportation throughout the nation



IN THE THOUSANDS OF MILES of Johns-Manville Transite Pipe in service today, you will find installations of almost every size and type. In big cities, small villages, in military camps and bases both here and abroad, Transite Pipe is serving efficiently in the transmission and distribution of water.

There are definite reasons for this wide acceptance. Made of asbestos and cement, Transite Pipe provides these important advantages:

Easy Handling. Light-weight Transite Pipe requires fewer men for handling. Only the larger sizes need mechanical handling equipment.

Tuberculation No Problem. Non-metallic in composition, Transite cannot tuberculate. Its initial high-flow coefficient (C=140) can never be reduced by tuberculation.

Low Maintenance. Made of asbestos-cement, Transite's corrosion-resistance and maintained strength contribute to its low maintenance costs.

Tight, Flexible Joints. Wide sweeps can be made with straight lengths because the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

Rapid Assembly. Even unskilled crews form tight joints easily, quickly with the Simplex Coupling.

For the complete facts, write to Johns-Manville for Transite Pipe Booklet TR-11A. For details on Transite Sewer Pipe for more efficient sewage disposal systems, ask for TR-21A. Johns-Manville, 22 E. 40th St., New York 16, New York.

TRANSITE PIPE IS AGAIN AVAILABLE FOR PROMPT SHIPMENT

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Asbestos

TRANSITE PIPE

FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES

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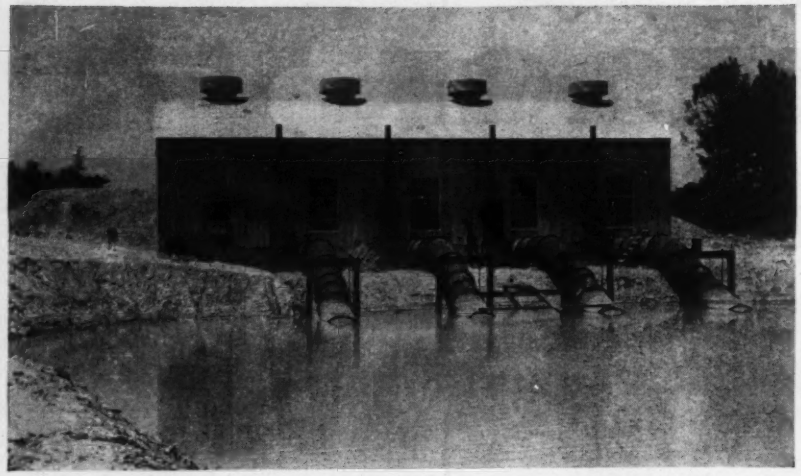


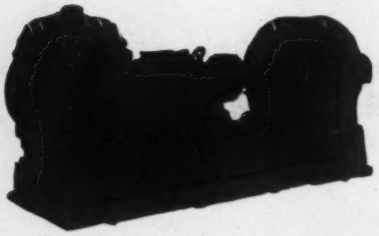
LIFE BLOOD FOR A DESERT

kept flowing by MORRIS Pumps

This illustration shows the intakes of four MORRIS Diesel-engine-driven Centrifugal pumps installed within the pump house and supplying water for a southwestern irrigation project.

It is an extremely special centrifugal pump application . . . but the same type of MORRIS high-efficiency, low-head, large-capacity pump is equally adapted for sewage handling, storm water drainage and other municipal and engineering projects. Other MORRIS Pump types are similarly advantageous for municipal water supply, fire protection, boiler feed, and general services.

Municipalities and private water companies all over the country have found that MORRIS Pumps assume the low-cost, highly dependable operation that creates outstandingly satisfactory pumping station records.



Heavy-Duty Lined Dredging Pump

Double Suction Horizontally Split Pump for Clear Liquids

MORRIS MACHINE WORKS Baldwinsville, N. Y.

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CENTRIFUGAL PUMPS

MEETINGS

AMERICAN WATER WORKS ASSOCIATION, annual conference, Milwaukee Auditorium, Milwaukee, Wis., June 13-16.

SEVENTH NATIONAL INSTITUTE FOR WARTIME TRAFFIC TRAINING, Northwestern University, Evanston, Ill., June 19-30.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 52nd annual meeting, Netherland Plaza Hotel, Cincinnati, Ohio, June 22-25.

AMERICAN SOCIETY FOR TESTING MATERIALS, 47th annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, Hotel Cleveland, Cleveland, Ohio, July 19-21.

REGIONAL AND LOCAL MEETINGS

CENTRAL STATES SEWAGE WORKS ASSOCIATION, annual convention, Oshkosh, Wis., June 22-24.

SEVENTH ANNUAL SHORT COURSE FOR SUPERINTENDENTS AND OPERATORS OF WATER AND SEWAGE PLANTS, sponsored by General Extension Division of Louisiana State University, the Louisiana State Board of Health and the Louisiana Conference on Water Supply and Sewerage, Geological Building, Louisiana State University, Baton Rouge, La., June 28-30.

WISCONSIN COUNTY HIGHWAY COMMISSIONERS AND WISCONSIN COUNTY HIGHWAY COMMITTEE MEMBERS' ASSOCIATION, jointly with WISCONSIN COUNTY BOARDS' ASSOCIATION, Green Bay, Wis., July 27-29.

NORTH CAROLINA SOCIETY OF ENGINEERS, annual convention, Wrightsville Beach, N. C., Aug. 4-6.

Elections and Activities

Ford Sargent, of Saginaw, has been elected president of the Michigan Road Builders Association succeeding Leon M. Denton of Detroit.

Other officers elected are Paul Greene of Whitmore Lake, vice-president; Herman Holmes of Crystal Falls, Upper Peninsula vice-president; A. H. Fry, Lansing, secretary-treasurer. Charles M. Upham, engineer-director of the

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"GUNITE" CONTRACTORS

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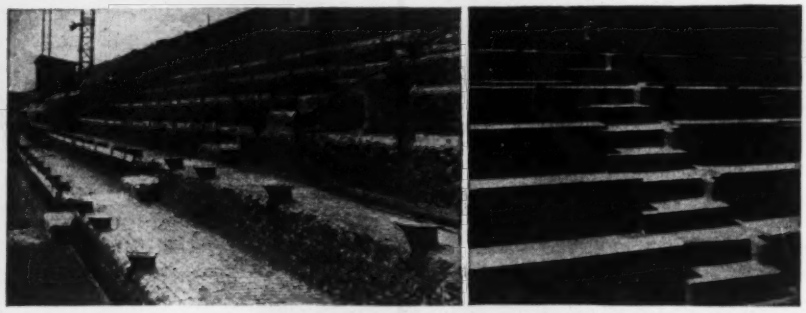

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The photos show the stadium of the Sharon, Pa., High School, a poured concrete structure built in 1933. After only 8 years it became so disintegrated as to be weakened, and was reconditioned by us with 2" and more of reinforced "GUNITE." View to the left shows chipping and sandblasting completed and the reinforcing mesh placed. To the right is the completed job, better than when new.

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GOOD FABRICATING SERVICE
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Photo: Drilling 22 holes in one operation on chord member, unit construction railway bridge for the U.S. Army Engineers.
MISSISSIPPI VALLEY STRUCTURAL STEEL CO.
Engineers and Fabricators
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American Road Builders' Associa was made a life member of the ciation and was presented with a pl "in recognition of outstanding ach ment in advancing sound princ and practices in highway engineeri The presentation speech was mad Jesse P. Wolcott ranking mino member of the House Roads Commi

Stanley R. Frost, of North Amer Cyanamid Ltd., on loan to the De ment of Labor, has been elected ch man of the Toronto branch of the gineering Institute of Canada. Pro sor C. F. Morrison of the Univer of Toronto is vice chairman and S de Jong continues as secretary-t urer. The executive committee con of E. A. Cross, A. H. Hull, R. F. gett, for one year, and D. G. Gr C. D. Carruthers and J. F. MacL for two years. Chief business at t ent is consideration of plans for erection of a joint architects and e neers building in Toronto as a p war project.

Rejection of any form of unio tion was voted by Ft. Worth Bra Texas Section of the American Soc of Civil Engineers, recently. C Harkrider, president, said they cussed the collective bargaining or ization plan recently suggested by CIO, then voted against the plan adopted "a strong resolution" aga unionization.

Through transfers and resigna of President M. F. Fuller and F Vice President D. H. Jones, C Larkey, Tulsa, has become acting pr dent of the Oklahoma Society of P fessional Engineers.

The Dallas, Texas, chapter of American Society of Civil Engineers elected R. R. Lutrick, president; R Kerr, vice president; J. L. O'Hea secretary and treasurer; and W. Swift and Frank W. Chappell, direct

The Metropolitan Section, Amer Society of Civil Engineers, at its ann meeting held May 17, elected Will McK. Griffin, deputy chief engin New York Tunnel Authority, presid and Harry O. Locher, vice presid New directors are Frank C. Mirg James E. Gibbons, and Roger W. Ar strong. Wm. J. Shea was reelected s retary.

President of the New Mexico Sect American Society of Civil Engine for 1944 is John R. Bliss, assistant st engineer. Mr. Bliss was graduated fr the Colorado Agricultural College 1925 and has been connected with t New Mexico State Engineers Of since 1926, specializing in water inv tigation.

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Ten years ago our scientists started working on a more effective way of restoring the masonry surfaces of concrete, stucco or brick buildings. Today America's buildings are able to profit from our long research. For we have created a coating which welds itself mechanically and chemically to exterior surfaces. It is called Waterfoil and is manufactured of irreversible inorganic gels. It forms a hard, heavy, fine textured surface coating from which water vapor may escape. Water absorption, however, is impeded, thus preventing serious reinforcing bar rust and spalling. Waterfoil contains only non-critical materials and is now available so that you can decorate and restore your disintegrating masonry walls and preserve your buildings for tomorrow. Any careful workman can apply Waterfoil. Send for the literature on Waterfoil now; all maintenance executives and property administrators should have it.

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THE UNIQUE TREATMENT FOR EXTERIOR MASONRY SURFACES

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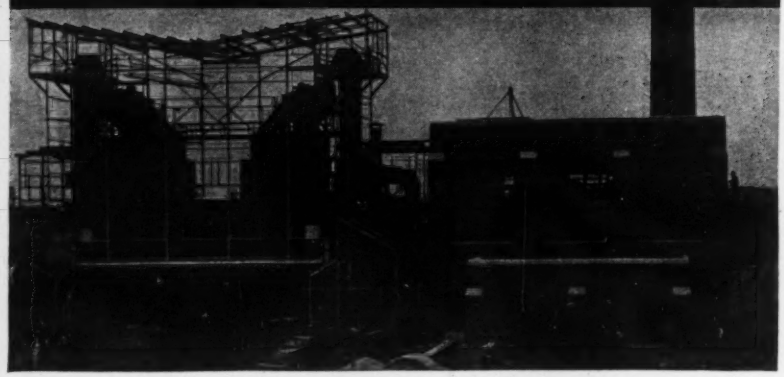

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FLUIDOMETER
Automatic Metering System —saves time, materials, insures accuracy and uniformity. For all types of asphalt.

● New York City has perhaps the world's biggest and toughest street maintenance and repair job. In spite of the heavy traffic and the great amount of repair work required, the streets of the big city are kept in amazingly good condition—year after year. One of the contributing factors is the dependable production of the five big Hetherington & Berner asphalt plants which serve the city. One of these plants is shown above.

H & B Asphalt Plants—the products of nearly 50 years of specialized experience—are built in both stationary and portable designs, and in capacities to meet the requirements of all size cities and jobs. Complete information will be furnished on request.

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MEN AND JOBS

Ted Appel has returned from Puerto Rico where he was associated with the Arundel Corp. on war construction and is now chief engineer for C. S. Johnson Co. at Champaign, Ill. He was formerly in the construction plant division of the Tennessee Valley Authority.

Personnel changes at the Wilmington, N. C., District U. S. Engineer Office have been announced as follows:

Capt. Leon C. McDuffie, Jr., Capt. Joseph J. Cole, Jr., Capt. John Disher, Jr., and 1st Lieut. James Norris are leaving for new assignments. Lawrence F. Tucker, associate civil engineer, has been appointed resident engineer at Ft. Bragg, Fayetteville, N. C., succeeding Capt. McDuffie; George Tienken, associate safety engineer, has been appointed district safety engineer to succeed Lieut. Norris; Maj. E. Smithfield has been appointed resident engineer at Camp Davis, succeeding Capt. Cole; Lieut. Lester W. Bray, resident engineer at Camp Butner, Durham, N. C., is assigned to the district office, Wilmington, as district engineer; and Erman R. Williams, associate engineer, has been appointed resident engineer, Camp Butner, relieving Lieut. Bray.

Milton Denault, formerly engineer with W. N. Brown, Inc., Washington, D. C., in charge of topographic mapping, is now assistant topographic engineer with the U. S. Geological Survey and is engaged on quadrangle work near Canastota, N. Y. He is the author of the article "Plane Table Versus Transit for Topographic Mapping," which appeared in *ENR*, May 4, p. 680.

Los Angeles Department of Water and Power recently reorganized the operations of its water system into eight major divisions. The new plan was recommended and is headed by **W. W. Hurlbut,** chief engineer of the water works and deputy general manager. Major units are: Distribution, **Laurance E. Goit,** engineer; **E. W. Breikreutz,** assistant; Los Angeles Aqueduct, **B. S. Grant,** engineer; **W. W. Wyckoff,** assistant; sanitary engineering, **R. F. Goudey,** engineer; **Harry Hayes,** assistant; electrical, **E. F. Leahey,** superintendent; **R. A. Erwin,** assistant;

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We are not thinking of tolerances when we thread a Buffalo bolt or nut. We are thinking that an American boy's life may depend on its accuracy and strength.

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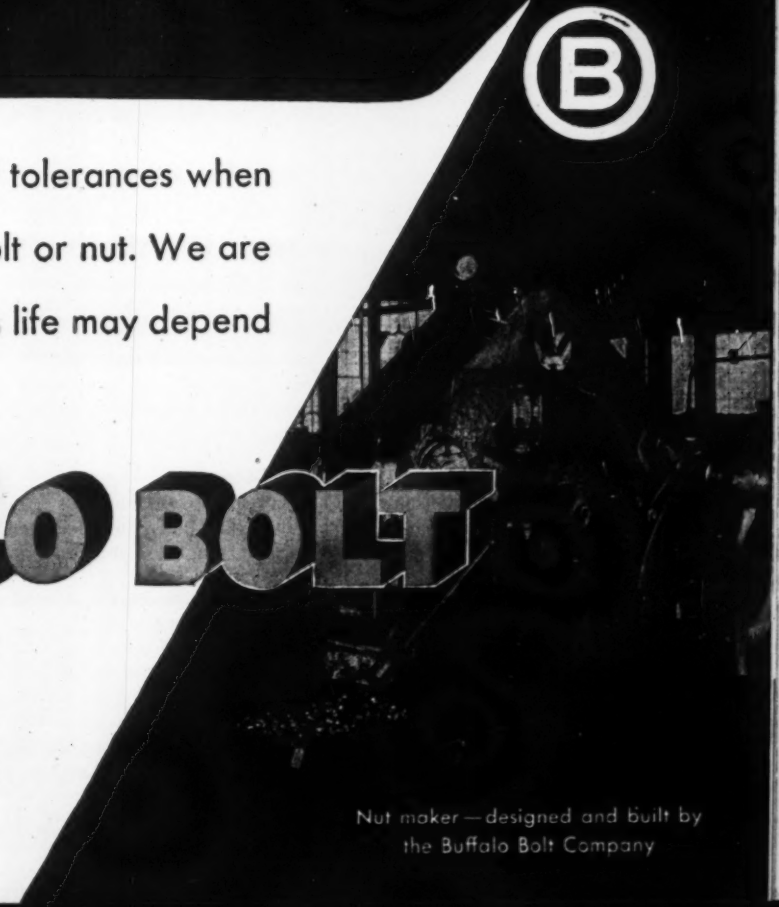

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In highly successful use for almost 55 years, the Warrington-Vulcan continues to be in wide demand. It is a simple and thoroughly dependable machine that has rapid, regular, and continuous action. It drives any kind of pile—wood, concrete, or steel. It is known by users everywhere for its freedom from mechanical troubles. A quick-acting and wide-opening exhaust prevents back pressure during the fall of the ram so that there is no diminishing of the force of the blow. Write for complete details.

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chanical engineering, **S. M. Dunn,** engineer; **J. T. Whitestone,** assistant; design, **D. J. Itter,** engineer; **M. K. Socha,** assistant; construction and field engineering, **H. L. Jacques,** engineer; **R. R. Proctor,** field engineer; and executive, **E. B. Mayer,** engineer.

James T. Derrig of St. Paul, has been promoted to assistant chief engineer of the Northern Pacific railway with headquarters at Seattle, succeeding **A. F. Stotler,** who becomes advisory engineer. **J. E. Hoving,** division engineer of Duluth, has been appointed office engineer in St. Paul, succeeding **H. R. Peterson,** who has been promoted to principal assistant engineer, in St. Paul. The district engineer's office at Livingston, Mont., abolished in 1930, has been reopened with **V. A. Bennett** in charge. **Mr. Bennett** has been assistant district engineer in St. Paul.

J. Dewey Clemmens, Ardmore, Okla., has been appointed a member of the Oklahoma State Highway Commission, succeeding Sam P. Hale, resigned.

George T. Gilman, associated with Moran, Proctor, Freeman & Mueser, consulting engineers, New York City, since 1928, has been admitted to full partnership.

William B. Nichol, has been appointed chief engineer of the Hamilton Bridge Co., Ltd., Hamilton, Ont. Mr. Nichol joined the company as designing engineer in 1937.

Maj. W. J. Ehlers, formerly attached to the post engineer office at the Army Transport Command base at Brownsville, Tex., as engineer at large, has become city engineer of Brownsville and director of the public works department. He has been a supervising engineer for the U. S. Government for the past ten years.

W. L. Lesher, Idaho district highway engineer at Shoshone for the last three years, has resigned to become city engineer at Burley. He will be succeeded at Shoshone by **Henry B. Sternberg,** senior highway engineer at Pocatello.

E. R. Suttie of Yarmouth, N. S., formerly plant engineer of Brandram-Henderson Ltd., has been named a brigadier in the Canadian Army.

Thomas R. Owen, engineer in charge of the Fayetteville, N. C. district office of the Federal Works Agency, has been transferred to Raleigh, N. C., to be in charge of a new district office. The Fayetteville office has been closed and the Raleigh office will handle FWA war public works in North Carolina with the

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..holds tight!
ELECTROLINE-FIEGE Wire Rope Connectors hold with a "Bulldog Grip" because their special design gives them a tighter bite. They are easy to install, streamlined and prevent dangers from undamped vibrations which cause crystallization, frayed cables and failures. Full rated cable strength in every connection.
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A life-giving drink of fresh sea water

PERMUTIT DESALTING BAG
INSTRUCTIONS
1-FILL BAG TO LINE WITH SEA WATER
2-ADD BRIQUET OF CHEMICAL. ROLL TOP OF BAG DOWN AND STRAP SECURELY.
3-ALLOW BRIQUET TO STAND FOR A FEW MINUTES. THEN KNEAD BAG WITH HAND FOR 10 MINUTES UNTIL BRIQUET IS BROKEN INTO A FINE POWDER.
4-SHAKE BAG OCCASIONALLY FOR 30 MINUTES SO DESALTING MATERIAL IS KEPT IN CONTACT WITH WATER.
5-NOW SUCK CLEAR FILTERED DRINKING WATER THROUGH OUTLET TUBE.
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Stowed in his rubber raft, he'll find a Permutit Sea-water Desalting Kit. It consists of a plastic bag and a supply of salt-removing briquets. That's all he'll need to change salt sea water into fresh, clear drinking water in a few minutes. The kit occupies only one-tenth the space of the drinking water it produces.

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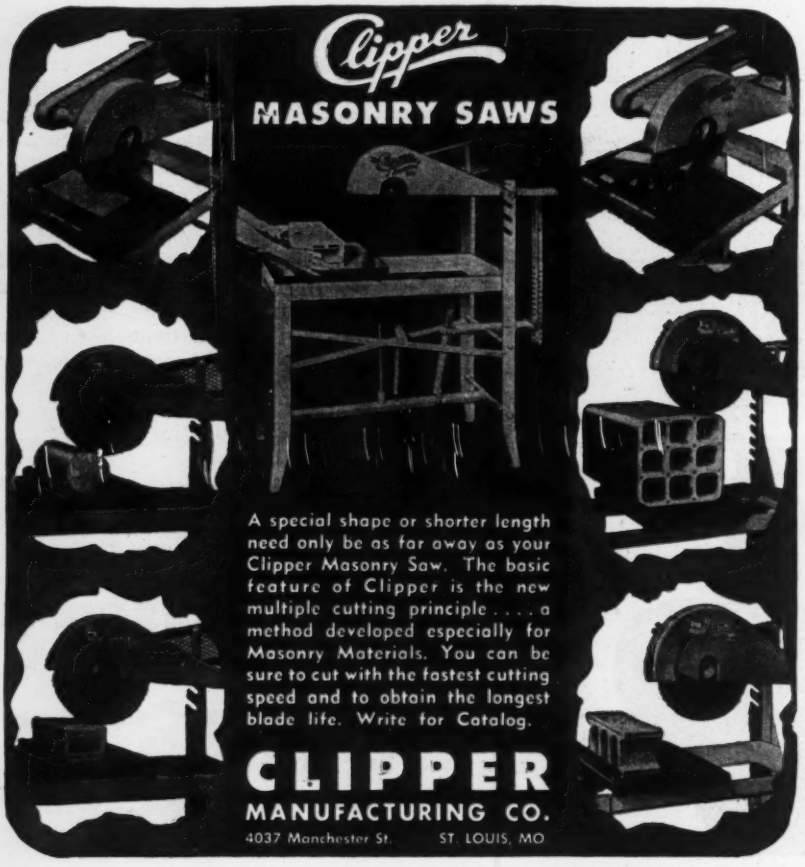
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MASONRY SAWS
A special shape or shorter length need only be as far away as your Clipper Masonry Saw. The basic feature of Clipper is the new multiple cutting principle . . . . a method developed especially for Masonry Materials. You can be sure to cut with the fastest cutting speed and to obtain the longest blade life. Write for Catalog.
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exception of the Wilmington area where Colin F. Churchill remains district engineer.

Col. J. Norman Pe..., Charlotte, N. C., engineer, is in the Pacific with the 369th Special Service Engineer Regiment which he commands. He formed it at Camp Claiborne, La., and it later moved to the West Coast, where it did a large amount of construction work.

Daniel H. B. Starr, formerly engineer of design, Connecticut State Highway Department, has been named engineer of location and design as successor to John H. Smith, recently promoted. The post of engineer of design has been filled by the transfer of Warren M. Creamer, associate highway engineer.

Col. Henry H. Hutchings, who was U. S. district engineer in Louisville, Ky., 1940-1942, has been nominated by President Roosevelt to be a brigadier general in the U. S. Army. A native of Texas he is a graduate of West Point and of the Massachusetts Institute of Technology.

Lieut. Col. L. H. Belk, has been named city engineer at Bismarck, N. D., to replace David R. MacDonald, who resigned to go with a construction equipment firm at Baton Rouge, La. He has been in the field artillery at Fort Sill, Okla., but is now retired.

Lieut. Col. Owen M. Carpenter of Charlotte, N. C., who was an engineer with the state of North Carolina prior to entering the Army, recently arrived in England after having been for some time at Elgin Field, Fla., as assistant chief of staff.

Lieut. Clifford H. Tilley of Bahama, N. C., is now an engineer with a Navy construction battalion in the Pacific.

Leonard F. Hubbard, formerly planning assistant to the New Hampshire State Planning and Development Commission, is now executive director of the White Plains, N. Y., Post War Planning Commission.

A. S. Hatch, superintendent of the water division of Houston, Tex., has been made supervisor of the city's 1944 $5,000,000 water supply improvement.

F. E. Spurney has joined Luther and Wood, engineers, Washington, D. C. He received his civil engineering degree from Cornell in 1923. He spent 15 years with the Turner Construction Co., New York, serving latterly as superintendent of construction and executive assistant to the vice-president.

(*Continued on page* 168)

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To help you get the utmost service—to assure smooth, efficient transmission of power—to prevent bearing failures and costly replacements—P&H has prepared a new lubrication chart for the vital jackshaft assembly. It's clearly illustrated and complete with directions on how to apply the proper oil or grease for each component part. Make use of it . . . keep your jack shaft *properly* lubricated.

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Send us a rough outline of your problem and we will return suggestions, estimates, or definite comparative cost information, without obligation. In detailing a job, Hausman prepares complete working drawings for coordination with contractor's forms, showing all openings for mechanical trades. Expensive field changes are eliminated.

Forms leased outright, or erected complete, including all centering underneath same.

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HAUSMAN RIBBED SLAB FORMS:
Long spans. Few laps. Structural channel soffits. No leakage. Straight, uniform joints. Ample working space. No reshoring. Shores directly superimposed. Maximum safety.

HAUSMAN SOLID SLAB FORMS:
For exposed solid slab ceilings. Steel beam supports eliminate need for intermediate shores. Large sheets of Presdwood minimize finishing costs. Rapid construction.

HAUSMAN ROUND COLUMN MOLDS:
Adjustable to all heights and diameters in 2-inch jumps. Easily and quickly stripped for re-use 24 hours after pouring. Standard conical heads in 6-inch multiples.

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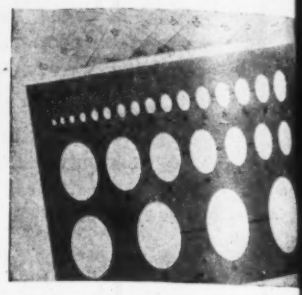
Ellipse Drawing Guide

Equally efficient for either pen ink, a new series of precision-cut templates will meet professional acy requirements and save much ti is claimed. Made of .020 thick cel templates, these guides may be us the untrained as well as the profes



worker, as the plot method of geo cal development is eliminated.

Available in sets of ten, 11 or rately, these guides have angles fr to 60 deg. by 5-deg. increments; plates of 60, 55, 50, 45 and 40 deg. ellipses from 1/8 to 3/8 in., increasi 32nds, then by 16ths to 1 in. Temp of 35, 30, 25, 20 and 15 deg. progre same, but start with, respectively, of 3/32, 3/16, 7/32, 1/4 and 3/8 in. Vertical horizontal axes are clearly indicat *The A. Lietz Co., 913 South Grand Los Angeles 15, and 520 Montgo St., San Francisco 11, Calif.*

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Non-inflammable and non-com tible, a new Alkyl Aromatic solvent centrate has no low volatiles; m with water, it produces a spark clear solution.

This solvent, processed from avail chemicals, is stated to be comple stable at elevated temperatures, an inhibit rusting of parts cleaned.— *Curran Corporation, Dowling B Malden, Mass.*

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Completely self-contained, a gasoline hammer paving breaker is to be comparable in power to lar breakers. This tool, weighing 96 lb designed for one-man operation; consumption is relatively low.

The hammer consists of a 2-cycle oline engine in inverted position.

A pair of 34-E Multi Foote Pavers working in tandem speed up completion of airport runways in America.

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ng airport runways and roads at record-breaking speed is an y day job for Multi Foote Pavers. They set more records than ther make, not only because there are more of them in service because all these features mean better mixing and faster ging and discharging:

DOUBLE CONE DRUM with its end-to-end scouring action insures a complete and thorough mix of every batch.

TROUBLE-FREE WATER SYSTEM is simple, accurate and independent of water pressure.

HIGH OPERATING PLATFORM assures greater visibility and faster, more accurate work.

ROTARY DISCHARGE takes only a quarter turn to kick concrete into the big bucket ready to speed out the long boom to be discharged.

BIG, WIDE, SOLID SKIP prevents spilling and assures fast, positive charging.

SIMPLE, RUGGED DRIVE provides fast, smooth action.

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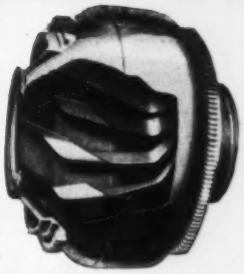
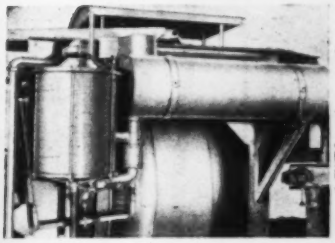
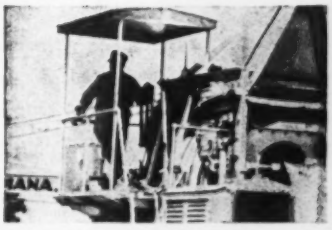


DOUBLE CONE DRUM

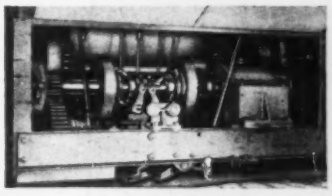


TROUBLE-FREE WATER SYSTEM

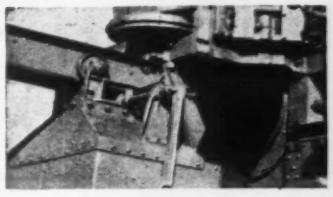
BIG WIDE SOLID SKIP



HIGH OPERATING PLATFORM



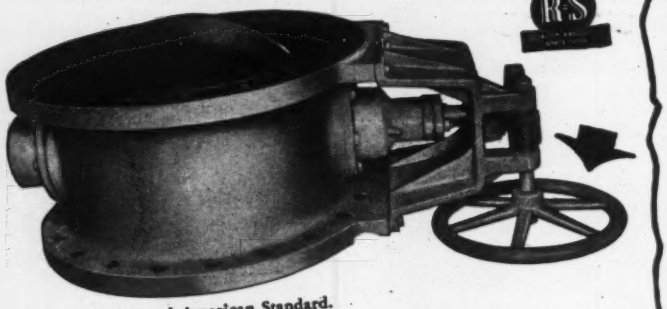
SIMPLE RUGGED DRIVE



ROTARY DISCHARGE

ARMY (E) NAVY

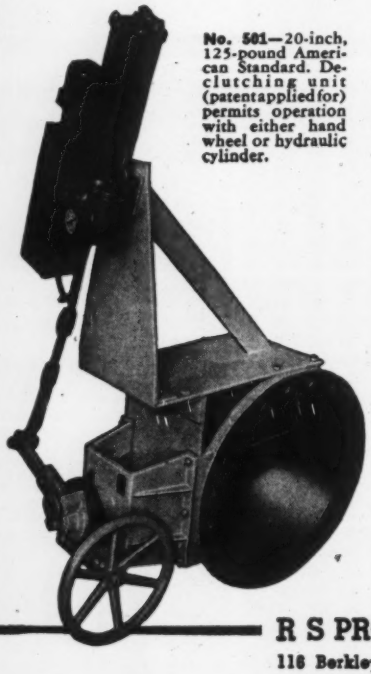
4 to 6 Hand Wheel Turns Open or Close Valve



No. 502—125-pound American Standard. Ball bearing mounted with stuffing box.

The quick operation of R-S Butterfly Valves is readily apparent. This is an important feature in any application but it is especially important where a battery of synchronous-driven pumps discharges into a common header. Burned-out motors at start-ups can be practically eliminated when R-S Butterfly Valves are installed, since it requires only a few seconds of an operator's time to shut off the discharge valves until the pump has gained the desired speed. The valves are then opened gradually, of course.

Equipped with hand wheel or chain wheel control, the standard 125-pound valves not only fulfill all requirements to better advantage, but cost less to purchase and install than conventional type valves.



No. 501—20-inch, 125-pound American Standard. Declutching unit (patent applied for) permits operation with either hand wheel or hydraulic cylinder.

NO SLAM—NO LINE DAMAGE

The 125-pound valve, equipped with hydraulic cylinder for power operation, prevents a synchronous-driven pump from grabbing all the load when the pump is started, prevents reverse flow and eliminates water hammer since the valve cannot move any faster than the bleeding of the cylinder discharge permits.

Straight-through flow—control and shut-off for any material that flows or is forced through a pipe..

Constructed in sizes to 84-inches and for **15 to 900 psi.** Write for Catalog No. 14-B.

VALVE DIVISION

R S PRODUCTS CORPORATION

116 Berkley St. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

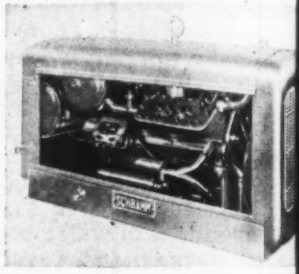
engine piston and one hammer
Starting is by a rope pull. The to

moil points, narrow or wide c
gads, frost wedges, asphalt cutters
all with 1⅛x6 in. shanks.—*Syntro*
328 Lexington, Homer City, Pa.

• • •

Compressor-Generator

Combining a Model 60 Fordair
pressor with a 5-kw. single phase
erator, a new machine provides a
pact source of compressed air and
tric current. The unit will produ



cu. ft. of compressed air at 100-lb.
pressure; or 5 kw. of single-phase
nating current at 120 volts; or, si
taneously, compressed air and el
current to the extent of the engine h
power.

This unit has a safety vacuum co
which limits the supply of air
pressed when an electric load is can
—*Schramm, Inc., West Chester, Pa.*

• • •

Adjustable Hole Cutters

Extremely adjustable for cu
holes in varying thicknesses of m
rials, a new set of three hole cutters
be used as hand tools, or in light
presses. They consist of a str
shank on a hexagon body, into w
are set 3 high-speed steel blades a

First Place

IN PLACING PERFORMANCE

,000,000 square yards of concrete . . . the equivalent f 180 miles of 20-foot road, and still going strong . . . at's the record of one Rex double drum paver. This xceptional concrete placing performance is typical of ex pavers. For consistent, high production yardage erformance . . . built-in stamina and ruggedness for e toughest jobs . . . Rex 34E double drum pavers are e leaders in the paving field.

In the Rex 34E, the batch transfer and entire mixing ycle are automatically controlled to the split second y the famous Rex Mechanical Man . . . a feature that liminates expensive wasted seconds. And the roomy, lear vision operating deck makes for ease of operation and faster job progress. The extended crawlers provide stability and allow the boom and bucket to be swung at right angles to the machine without tipping.

For complete information on Rex Pavers and how they can help speed your jobs, send for your free copy of Bulletin 407. And check the other Rex construction equipment: Moto-Mixers, to speed the mixing, hauling and placing of concrete . . . Pumpcretes, the pumps that pump concrete by pipe line . . . Pumps that move water economically and efficiently . . . Mixers that cut concrete mixing costs. See your Rex Distributor or write Chain Belt Company, 1633 West Bruce Street, Milwaukee 4, Wisconsin.

CHAIN BELT COMPANY
of Milwaukee

REX

CONSTRUCTION MACHINERY

PUMPS PAVERS PUMPCRETES MOTO-MIXERS MIXERS

deg. intervals. The shanks are heat-treated and the three blades are precision ground.

It is claimed that the balance provided by the special three-blade design makes it possible to cut holes in curved or irregular surfaces, and that standard and "problem" materials may be successfully handled.—*Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif.*

• • •

Long-Distance Thermometer

Equipped with Accurator tubing between the bulb and the instrument, to measure temperature at a point remote from the medium, a new Series 53K Taylor thermometer has a wide variety

of standard temperature-sensitive bulb constructions and extensive temperature ranges. An outstanding feature of this 4½-in. dia. mercury-actuated instrument is its corrosion- and shock-resistant phenolic case.

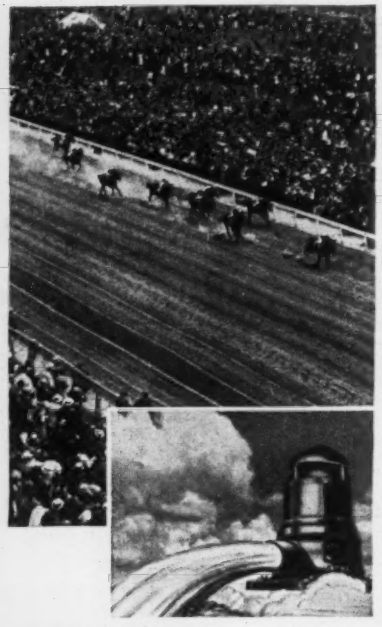
The black metal dial with white figures makes for easy reading at a distance, it is claimed.—*Taylor Instrument Companies, P. O. Box 110, Rochester 1, N. Y.*

• • •

Flow Meter

Streamline Venturi construction improves a new propeller-type flow meter, called Propeloflo. This unit has an 8-blade bakelite propeller moulded in one piece. Rotation is transmitted through spur and bevel gears, and a Venturi throat evenly distributes the flow force against the full area of the propeller. Spiral flow is eliminated, it is claimed, by straightening vanes upstream of the propeller.

Fine grit, sand or scale are diverted from the mechanism by the streamlined parts, and the unit is said to be easy to service and lubricate. A blank cover may be installed when the meter is removed. Whenever debris may carry



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MUST HAVE QUALITY . . . AND ENDURANCE

Maybe you didn't have your money on the winner in the 70th Kentucky Derby! Maybe you couldn't pick a horse like Pensive from a field of 16 starters. But one thing you did know—and have always known—is that it takes quality and endurance to win in any race.

In buying your postwar Water System, you had better remember the quality-endurance formula. You can't afford to own an "also ran" water system when the days of war are over and peace is here again.

You can put your money square on the "nose" of a Layne Water System — and always win. You will win on quality and endurance. You will get large quantities of water at low cost. You will get dependable performance year in and year out. And you will get a mighty big reward in knowing that you own the world's finest and most efficient Water System.

Right now is a good time to make preliminary plans. You can secure the aid of Layne Engineers without obligation. You can get set for the days of peace. Late literature will be helpful. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

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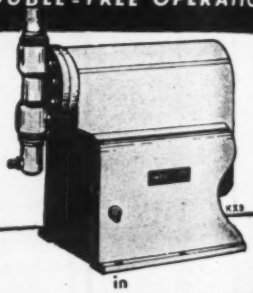

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lifting power

PURPLE STRAND WIRE ROPE

Superior lifting power—and plenty of reserve strength—is what's needed in construction jobs like this one, where giant cranes waft tons of steel through the air.

Lifting power is what Purple Strand has in abundance. This top-quality Bethlehem wire rope is the product of more than fifty years' experience in wire-rope manufacture. It is manufactured under close metallurgical control from blast furnace to stranding machine.

"Purple Strand" means that the rope is made of Improved Plow Steel—the huskiest steel used in any wire rope. For greatest durability and ease of handling, specify not only Purple Strand but "Form-Set"—which means that the wire rope is preformed rope, given its helical shape both in the individual wires and in the strands. Unlike ordinary rope, whose wires contain pent-up stresses and are possessed with a permanent urge to straighten themselves out, preformed rope is stable and relaxed, more resistant to bending fatigue, and much easier to spool and handle.

Make a note to order Form-Set Purple Strand Rope. But order it, please, as far in advance as possible, so that you'll be sure to have it when you need it.

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

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Our department has 6 INDIAN FIRE PUMPS and all the firemen are well pleased with them. Since equipping with INDIANS, we have discarded our soda acid extinguishers. When called out to a fire the first thing the men grab hold of are your INDIAN FIRE PUMPS and they certainly **DO A SWELL JOB.**

Yours very truly, Natrona Volunteer Hose Company

D. B. SMITH & CO., UTICA, N. Y.

Kindly send us 2 more INDIAN FIRE PUMPS. During the early spring the weather was very dry and our department became well acquainted with our present INDIAN FIRE PUMPS as we had a great many prairie fires. Please hurry these 2 along.

Lake Bluff Fire Department

We receive hundreds of letters like these. INDIAN FIRE PUMPS, using only clear water, are the fastest way to extinguish INSIDE and OUTSIDE fire in their early stages. Order now or send for new catalog.

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Crawler or Truck—Gas or Diesel

10 Models of 3/4-5/8-1/2-3/8 cu. yd

THE **BYERS** MACHINE COMPANY

RAVENNA OHIO

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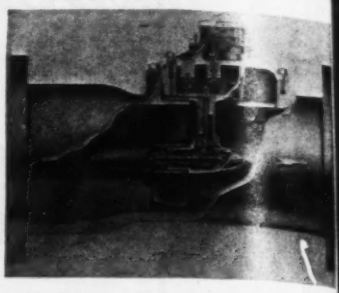
along the line with the moving fluid the manufacturer can furnish a pip

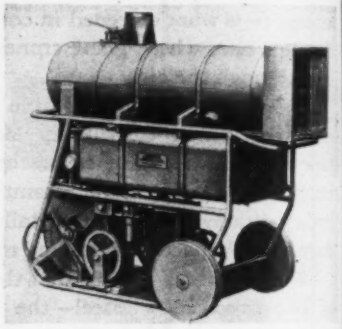


section having a coarse screen and hand hole, to be inserted upstream from the meter.—*Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.*

• • •

Portable Heater

The "whirl-flame" combustion principle of the new "Janitrol" portable heater imparts great dependability, it is claimed, and permits instant lighting in sub-zero temperatures. Because of continuous ignition and a self-pilot com-



bustion process, the heater is said to be blowout-proof.

This heater will operate on any grade of gasoline, kerosene, or with minor modifications, on other liquid fuels. Mounted on a two-wheeled carriage, the unit may be moved like a wheelbarrow or pulled like a sled over snow or mud. The center of gravity is directly over the wheels when lifted to position for hand wheeling. Among other significant features are the heater's inherent safety design, large tank capacity and simplicity of maintenance and service.—*Surface Combustion, Toledo, Ohio.*

• • •

Lath and Plaster Partition

A new economy partition is available that is quickly erected, strong, light weight, and won't burn, according to the manufacturer's announcement. The 2-in. solid partition of Rocklath plasterboard and Red Top plaster drastically cuts lumber and metal requirements.

The installation of this government-

FACTS ON TRANSITE SEWER PIPE

INSTALLATION . . . Transite's long lengths reduce the number of joints needed in the line . . . its light weight permits easier, faster, more economical handling.

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DELIVERY CAPACITY . . . This advantage of Transite Pipe frequently permits smaller pipe or flatter grades, resulting in shallower trenches.

LABLE BOTH FOR FORCE MAINS AND GRAVITY LINES . . .

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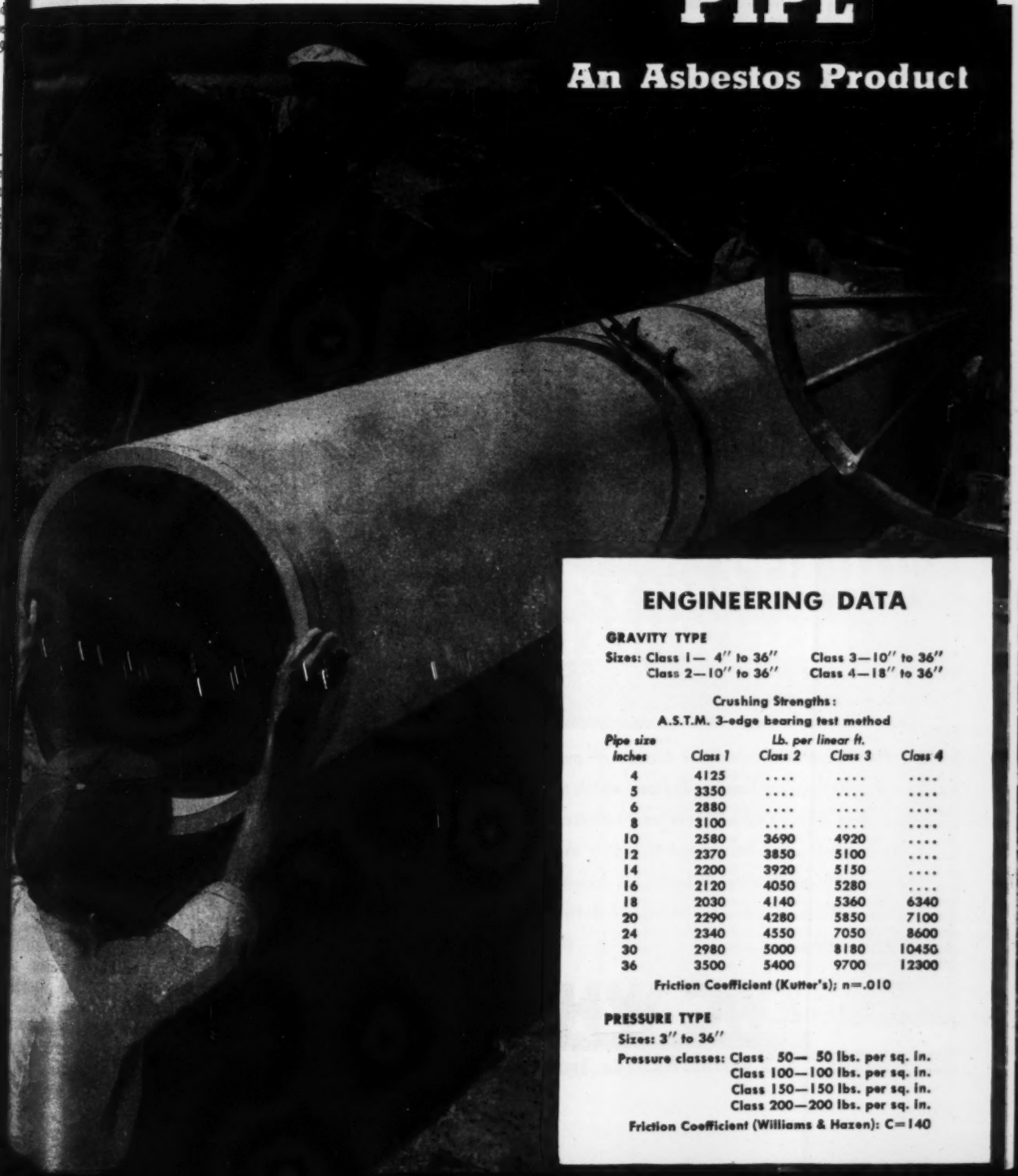
An Asbestos Product



ENGINEERING DATA

GRAVITY TYPE

Sizes: Class 1— 4" to 36" Class 3—10" to 36"
Class 2—10" to 36" Class 4—18" to 36"

Crushing Strengths:

A.S.T.M. 3-edge bearing test method

Pipe size Inches	Lb. per linear ft. Class 1	Class 2	Class 3	Class 4
4	4125	....	....	....
5	3350	....	....	....
6	2880	....	....	....
8	3100	....	....	....
10	2580	3690	4920	....
12	2370	3850	5100	....
14	2200	3920	5150	....
16	2120	4050	5280	....
18	2030	4140	5360	6340
20	2290	4280	5850	7100
24	2340	4550	7050	8600
30	2980	5000	8180	10450
36	3500	5400	9700	12300

Friction Coefficient (Kutter's); n=.010

PRESSURE TYPE

Sizes: 3" to 36"

Pressure classes: Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.

Friction Coefficient (Williams & Hazen): C=140

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Make best use of available

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Rocklath is 24 in. wide and 3/8 or 1/
thick, with square long edges and in
ceiling-high lengths, up to 9 ft. 6 i
U. S. Gypsum Co., Chicago, Ill.

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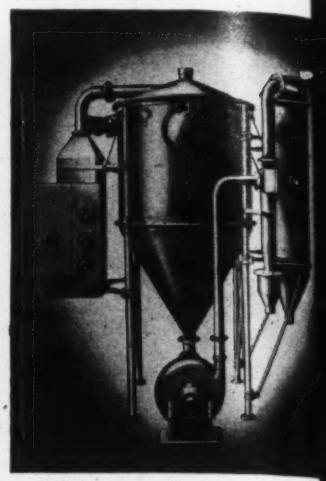
Offering several advantages for
ing products, a new Type N. Turbul
spray dryer is a completely packa
unit, with dryer, blower and Multic
collector in one compact assembly.



of black iron, stainless steel or ot
alloys, and occupies a 5x9 ft. 8 in. fl
space, with a headroom of about 10
6 in.

This dryer is rated at an evaporat
of 25 lb. of water per hour at an in
to-outlet temperature differential of
deg. F. Maximum operating flexibil
is gained by either direct or indir
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provided with a secondary inlet for
troducing air of any temperature
sired for experimental investigations
*Western Precipitation Corp., 1016 W
9th St., Los Angeles 15, Calif.*

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Steel and timber are combined to
extent not previously used in structur
members in a design developed by Al
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core for compression stresses, entire
encased in steel plate, which takes t
tension load. The steel covering
welded at the corners for comple
weather protection for the wood and
increase its strength as a box-beam
box-column.

It is said to make excellent lo
foundation piling as well as structur
members, and to be more fire resistan
than either wood or steel.—*"RST" E
gineering Company of America, Hig
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Conserve it With A Slide Rule"

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No. 1452D: Ten-inch Celluloid Face bevel edge slide rule. Inches and metric rules on bevel edges. List Price.....$3.50

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No. 1444D: Five-inch Celluloid Face pocket slide rule with convenient additional reference charts. List Price.....$2.25

These "emergency" slide rules—for immediate delivery—have Scales A, B, C1, C, D, and K on front. On reverse: Scales S, L, and T.

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Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability of flexible casings, cores, vibrators. Operates on 80 lbs. pressure.

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Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability — Flexible Casings, Cores, Vibrators. Universal type motor. Built-in protective "ground."

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Mercury clutch, entirely automatic, picks up load at 1500 r.p.m. allowing engine to idle without running vibrator, eliminates stalling, makes starting easy in cold weather.

Upsetting is practically eliminated in mounting. Handles allow complete unit to be easily carried.

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MANUFACTURERS' ACTIVITIES

Frank B. Allen, president of the Allen-Sherman-Hoff Co., Philadelphia, Pa., has been awarded the Edward Longstreth Medal of The Franklin Institute, for his invention of a seal ring for use in centrifugal pumps handling abrasive solutions. The citation reads: "In consideration of the development of a pump which will successfully handle water or liquids containing abrasive materials, retain its initial efficiency and original discharge for considerable periods, with low maintenance costs, and the successful manufacture of this type of pump, giving satisfactory operation in many installations."

LaPlant-Choate Manufacturing Co., Cedar Rapids, Ia., builder of earth-moving and land clearing equipment, has opened a sales office in Rockefeller Center, New York City, in charge of Jay Fetters, formerly London manager of Caterpillar Tractor Co., and more recently on the staff of the Chief of U. S. Army Engineers. Mr. Fetters also represented Caterpillar for six years in India, Burma, Afghanistan and Ceylon.

James F. Reid formerly deputy chief of the War Production Board's alloy steel branch, has been appointed production manager of all divisions of Timken Roller Bearing Co., Canton, Ohio. Before 1942, he had served for ten years as production manager for the Timken Steel and Tube division. He joined the Timken organization 25 years ago.

Marmon-Herrington Co., pre-war builder of all-wheel-drive trucks, announces that full-scale production is being resumed immediately, following receipt of a new contract for a large number of specially designed trucks, for the Army. Activities in the plant at Indianapolis, Ind., have been curtailed somewhat recently while the company has been tooling up and getting in materials for the new contract. Since Pearl Harbor, it has designed and built thousands of military tanks, track-laying tractors and trucks.

WANTED: *New*

Have you a new product, device or process that will accomplish a result faster, cheaper or better than those now in use? If so consult us at once. We have been retained by a number of companies in a wide variety of industries to find new products and processes for post-war. If your idea is acceptable to them an attractive contract for purchase or licensing will be arranged. (Our service is *free* to you.) Send a copy of patent, or drawings and description and tell us whether a model is available. All information treated in strictest confidence. Write to—

NEW PRODUCTS DIVISION

DESIGNERS FOR INDUSTRY, INC.

2515 DETROIT AVE., Dept. R-6, CLEVELAND 13, OHIO

Compact! Powerful! Sa

DISTRIBUTABLE CONTROLL POWER

with

ALL STEEL HAND HOIST

SEATTLE, U.S.A.

Money Has Been Saved on These J

1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.

Hudson River Bridge sidewalks were laid in sections with 32—5-Ton Beebes.

Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

★

When raising, lowering, or placing costs by power are a serious problem, the answer is the number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and Ton sizes. Sold through leading dealers in trade centers. List of dealers sent upon request.

BEEBE BROS., 2720 6th Ave. S., Seattle 4, U.S.

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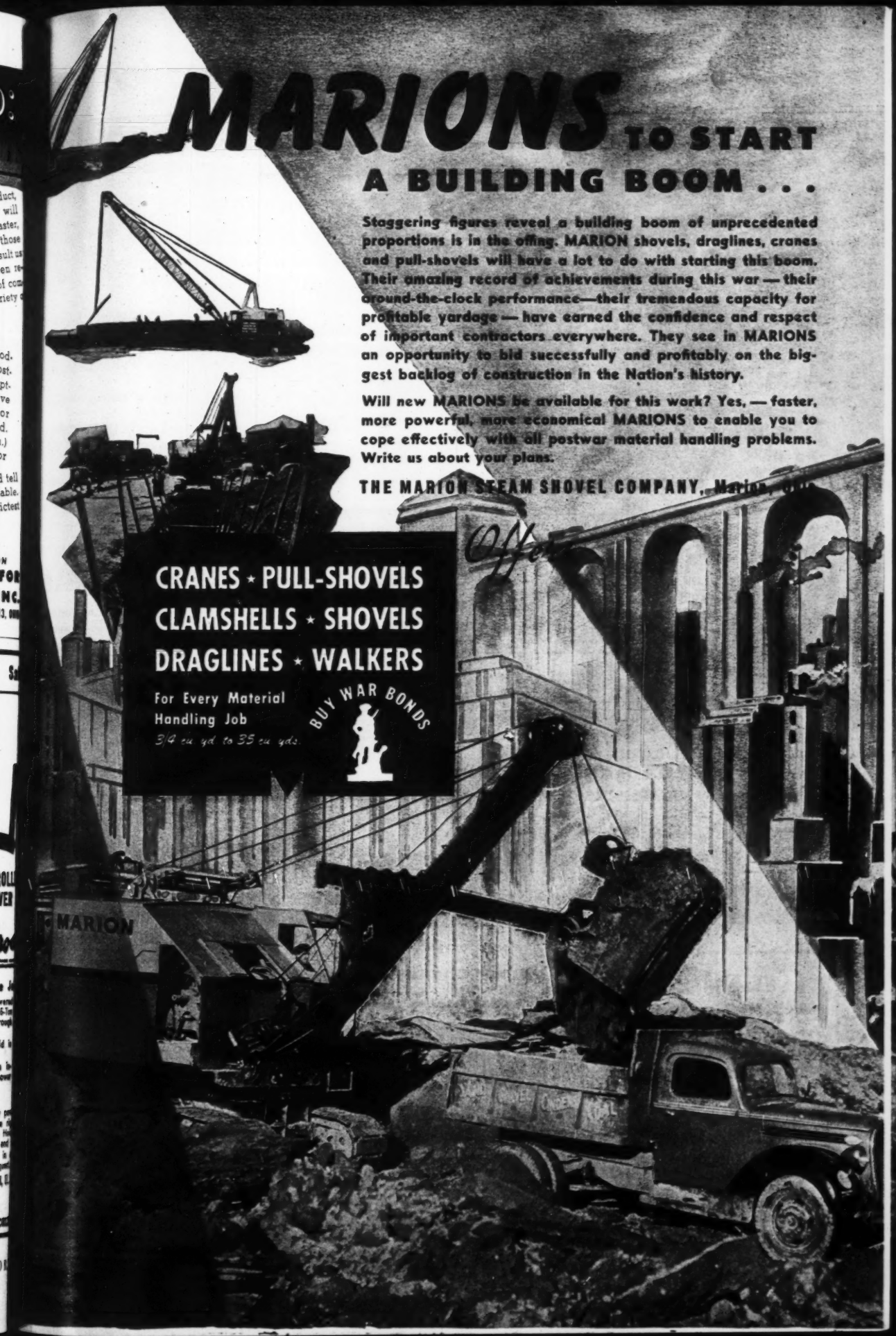
"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WOR


MARIONS TO START
A BUILDING BOOM . . .
Staggering figures reveal a building boom of unprecedented proportions is in the offing. MARION shovels, draglines, cranes and pull-shovels will have a lot to do with starting this boom. Their amazing record of achievements during this war — their around-the-clock performance—their tremendous capacity for profitable yardage — have earned the confidence and respect of important contractors everywhere. They see in MARIONS an opportunity to bid successfully and profitably on the biggest backlog of construction in the Nation's history.
Will new MARIONS be available for this work? Yes, — faster, more powerful, more economical MARIONS to enable you to cope effectively with all postwar material handling problems. Write us about your plans.
THE MARION STEAM SHOVEL COMPANY, Marion, Ohio
CRANES • PULL-SHOVELS
CLAMSHELLS • SHOVELS
DRAGLINES • WALKERS
For Every Material Handling Job
3/4 cu yd to 35 cu yds
BUY WAR BONDS
MARION

HOW TO KEEP COOL WITH A REZNOR UNIT HEATER

If you have difficulty in buying fans, you will be glad to know that you already have an electric fan in each of your Reznor Unit Heaters.

SHUT OFF GAS— TURN ON FAN

Separate controls enable you to shut off gas and turn on the fan in each Reznor suspended unit heater. Thus you eliminate the heat and gain the cooling effect of forced circulating air through plant or office.

GET YOUR ORDER IN EARLY FOR NEXT WINTER'S HEAT

By placing your order now, you will get earlier delivery on Reznor Unit Heaters and you will be all set for next heating season, come early or late. You will also get plus benefit of summer cooling.

SEND FOR CATALOG AND MAKE YOUR SELECTION

There are several models of self-contained Reznor Unit Heaters. Write for the catalog and make your choice.

REZNOR MANUFACTURING CO.
105 JAMES STREET, MERCER, PENNA.

REZNOR

"GAS HEATERS EXCLUSIVELY SINCE 1888"

Election of three new vice presidents of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has been announced. They are William C. Johnson, James M. White and William A. Roberts.

Johnson, a native of Alabama, joined the company in 1924. After serving in district offices, he became sales manager of the crusher and cement division. Next, he was placed in charge of general sales in 1942, succeeding Walter Geist, who became president.

White also is a native of Alabama. He joined the company in 1929 upon being graduated from the Alabama Polytechnical Institute. His first work was as "trouble shooter" on shop and field jobs. In 1934, he was made manager of the company's La Porte, Ind., works. He returned to Milwaukee in 1941 to become assistant general works manager, and was elevated to works manager in April, 1942.

Roberts, born at Osceola, Mo., joined Allis-Chalmers as a salesman after experience as a road contractor and salesman. He became Canadian representative and then for a time operated his own agency at Regina, Sask. In 1930 he returned to Milwaukee as agricultural sales manager of the tractor division.

DELAWARE BAY SHIPBUILDING CO., INC.
LEESBURG, NEW JERSEY

BULKHEADS
PILEDRIVING
WHARF CONSTRUCTION
MARINE RAILWAYS

WILLIAMS *Buckets*
WELDED ROLLED STEEL CONSTRUCTION
All types and capacities for all conditions. Send for Catalog.
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7000 Central Avenue
Cleveland, Ohio
built by WELLMAN

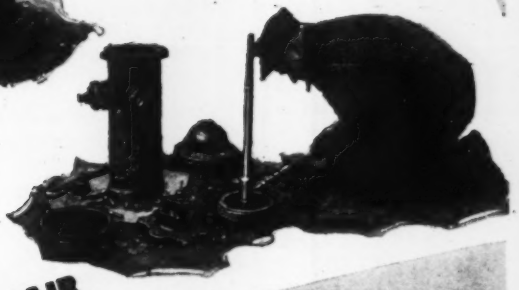
THE MOUNT VERNON BRIDGE CO.
Engineers Contractors
STRUCTURAL STEEL
RAILWAY AND HIGHWAY
BRIDGES
BUILDINGS AND VIADUCTS
MOUNT VERNON, OHIO

THE *Labor-Saving*

FIRE HYDRANT

IN MAINTENANCE

IN OPERATION

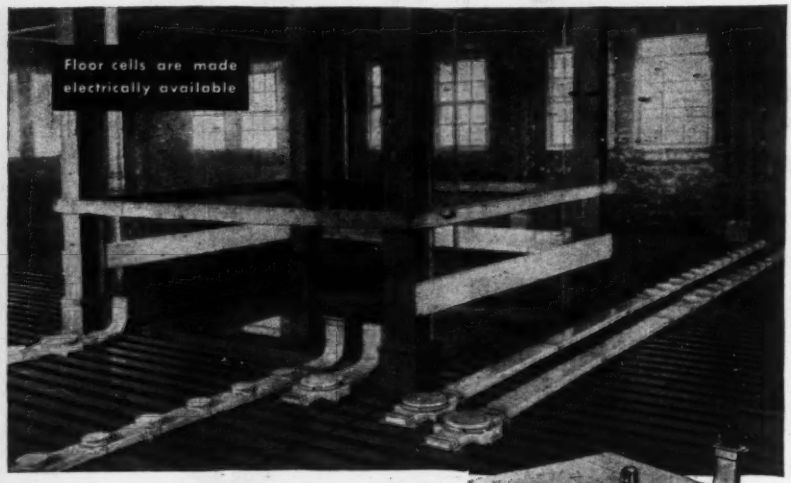


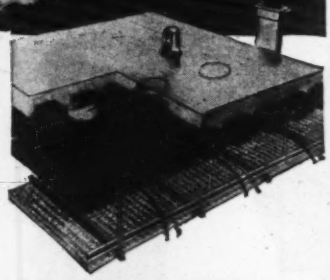
IN REPAIR

MANPOWER . . . a prime war-time shortage . . . is conserved by SAFETOP. Its maintenance requires only a few minutes once or twice a year for inspection. Its simple, long-lasting mechanism practically never requires adjustment. If broken by a colliding vehicle, the repair is a one-man job, requiring less than half an hour. And it conserves the firemen's time, too, because of its immediate response and ease of operation. Send for bulletin describing this LABOR-SAVING fire hydrant in detail.

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

KENNEDY *Safetop* HYDRANT





G-E

Q-FLOOR WIRING

Provides Undreamed

ADAPTABILITY - FLEXIBILITY - AVAILABILITY

In Office Buildings and Factories

Imagine having electrical power available every few inches in office and factory floors! G-E Q-Floor Wiring gives you this unusual adequacy in Robertson cellular steel floors. Changes can be made at any time in office or factory set-ups . . . with new power, telephone and signal connections readily available.

G-E Q-Floor Wiring is completely flexible. It makes buildings flexible too, and adaptable. Floor space is always available for new uses. What is more, every bit of space can be used efficiently. For further information, see the nearest G-E Merchandise distributor or mail the coupon for a catalog.

BUY WAR BONDS

Hear the General Electric radio programs: The G-E "All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

General Electric Company
Section C641-116
Appliance and Merchandise Dept.
Bridgeport, Connecticut

Sirs: Please send me a copy of the G-E Q-Floor Wiring catalog.

Name .....

Address .....

City ..... State .....

GENERAL ELECTRIC

in 1941 succeeding the late Harry C. Merritt as division manager.

T. C. Knudsen has been named manager and chief engineer of the new texrope department, which will handle multiple V-belts and sheaves. Mr. Knudsen has been closely associated with the texrope drive from its inception. He joined Allis-Chalmers in 1942 in the milling machinery department.

Worthington Pump and Machinery Corp. has appointed Walter D. Smith of Tulsa, Okla., as commercial vice president. A graduate of Carnegie Institute of Technology, Mr. Smith has been connected with the Worthington organization since 1923, except 1933–36, when he was vice president and general manager of the American Natural Gas Co. of Shamrock, Tex. Mr. Smith will supervise business in the Southwest.

Thad Eaton, assistant treasurer, Caterpillar Tractor Co., Peoria, Ill., has resigned to enter a partnership with John Perkins, Caterpillar distributor for Boston, Mass., and vicinity. Eaton joined the company in 1928, starting as assistant credit manager for the Middle West. After a year he was made assistant credit manager for export, and became manager of that section in 1938. Succeeding Mr. Eaton as assistant treasurer is Virgil V. Grant, who joined the company in 1936, shortly after graduation from the University of Illinois.

George H. Rose has been appointed assistant to the vice president of the American Steel & Wire Co., Cleveland, Ohio, U. S. Steel subsidiary. Mr. Rose has been associated with the company for 39 years, having started as a draftsman at the Newburg Steel Works in Cleveland in 1905. He has been chief engineer since 1937.

Eugene J. Reardon has been promoted to chief engineer, succeeding Mr. Rose. A native of Connecticut, Mr. Reardon studied metallurgical engineering at North Eastern University. He joined the company in 1922, and has been assistant chief engineer since 1942.

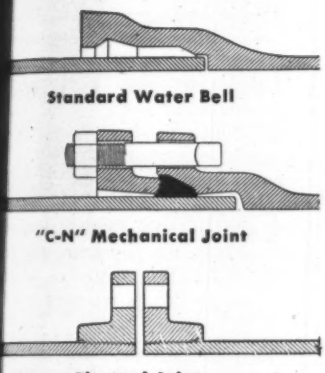
Murray G. Day has been appointed New England representative of the National Valve & Manufacturing Co., Pittsburgh, Pa., with offices at 201 Devonshire St., Boston 10, Mass. He also represents the Connery Construction

B. CLOW & SONS General offices at 201-299 N. Talman Ave. CHICAGO 80, ILLINOIS

Manufacturers of

Super-deLavaud Cast Iron Pipe

and Fittings



Standard Water Bell

"C-N" Mechanical Joint

Flanged Joint

Clow-National organization has been ac- engaged in the Water Works field for than sixty-five years, maintains sales in all principal cities, and operates plants d at Chicago and Birmingham, and at cton and Newcomerstown, Ohio.
are very grateful for the business that ave placed with us, and sincerely hope n every case we have shown our appreci- through prompt deliveries and efficient ing of your orders.

IT WILL BE A PLEASURE to meet old friends and make new ones at our Booth, Number 55, during the American Water Works Association's Annual Conference in Milwaukee—June 13th to 16th. Also, we will be very pleased to have you visit our Chicago Plant on your way to or from the Conference—if your plans will permit you to do so.

And, now, just a word about cast iron pipe. It is available. The War Production Board will give sympathetic consideration to applications for priority rating when request is made on WPB form 2774. Let us know if we can be of service.

Ideal weather for pipe line work is here and there is no time like the present for getting that job of yours under way. Let's get together and talk it over—any time at your convenience.

Everything for the municipal water supply system

JAMES B. CLOW & SONS

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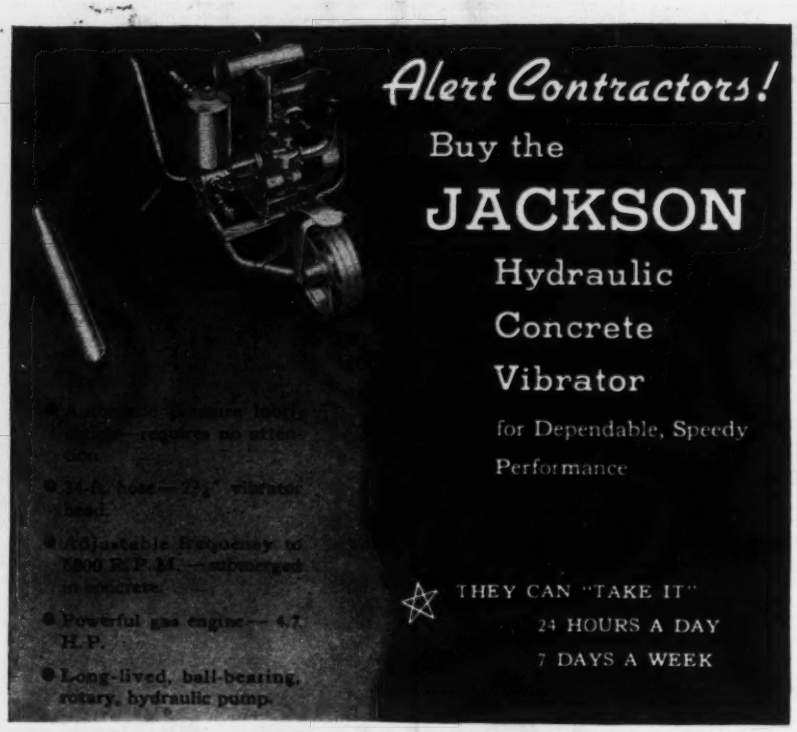
NATIONAL CAST IRON PIPE
(A Division of James B. Clow & Sons)
BIRMINGHAM 2, ALABAMA

CAST Q IRON



ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

How to read
MILITARY MAPS
How to interpret
AIR PHOTOGRAPHS
—explained in easily understood form

Here, in one volume, are all the techniques of modern map reading. From this comprehensive book one can acquire the basic principles of map reading, the techniques, habits, and abilities characteristic of a good map reader. The full explanatory and illustrative material provides a complete factual approach to the visualization and understanding of the landscape as depicted in maps and air photographs and also gives much to enable the reader to blend common sense with map skill.

Just Published!

Military Maps and Air Photographs

This book contains all the basic material on the subject including an explanation of the standard methods and modern applications in map reading presented clearly and simply. It covers in detail topographic forms—gives techniques and methods for advanced map reading—deals with problems in the field, landscape types, the use of air photographs, etc., etc.

By A. K. LOBECK
Professor of Geology, Columbia University
And WENTWORTH J. TELLINGTON
Captain, Cavalry: Instructor, Department of Military Topography and Graphics, United States Military Academy
255 pages, 8½x11, 361 illustrations, $3.50

Read this list of chapter headings

Basic Map Reading
Fundamental Requirements
The Topographic Sheet
Elementary Problems and Methods
Topographic Forms
Advanced Map Reading
Techniques and Methods in the Field
Landscape Types
Constructional Forms: Plains, Plateaus and Mountains
Destructional Forms: Landscape Details
Air Photographs
The Fundamentals
Uses in the Field
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Comprehensive Problems
The Mannheim Map

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Send me Lobeck and Tellington—Military Maps and Air Photographs for 10 days' examination on approval. In 10 days I will send $3.50, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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Co. and Quaker City Iron
Philadelphia, and Thomas
Coupling Co., Warren, Pa.

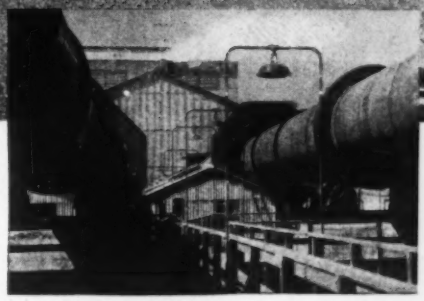
Post-war plans at the Tremco
facturing Co. of Cleveland, Oh
Toronto, Ont., recently brou
election of Gordon Hann to the
of directors and the promot
Harold Pilskaln to direct ne
struction and industrial conver
velopment in the United States.

Hann, who joined the Trem
ganization in 1932 upon his graduation from the Case School of Applied Science, assumed the post of research director in time, and in 1939 was named director of manufacturing and product development. He will continue to vise the development of Tremco ucts for the maintenance of ne standing industrial properties, pitals, public buildings, utilities commercial establishments.

Pilskaln started at Tremco in as a field representative in Ohio. He became assistant sales manager in 1935. Since the start of the war he has been serving industries using Tremco products in the manufacture of implements of war and waterproofing sealing of seas shipments. Pilskaln will pr Tremco building materials when ate construction is resumed.

Thomas Burress, tank sales dir manager for the Heil Co., Milwa Wis., recently was honored for pleting 25 years of service, the la teen as sales manager. Burress pioneered many Heil develop among them the frameless petro transport tank.

R. G. LeTourneau, Inc., which cently announced plans to establis exclusive distributor organization, named several leading dealers. cluded are Loggers and Contra Machinery Co., Portland, Ore.; Victor L. Phillips Co., Kansas Mo.; the Nicoll-Talcott Corp., ford, Conn.; Wylie-Stewart Machi Co., Oklahoma City, Okla.; and eral Supply and Equipment Co., Baltimore, Md.



Austin Company—Architect, Engineer, Manager

K&M "Century" Asbestos-Corrugated and Flat Sheet Material is available now

Approximately 15,000 tons of K&M "Century" Asbestos-Corrugated Roofing and Siding have been used in the plants of this company . . . one of the largest magnesium producers in America. From these plants come much of the magnesium responsible for many of America's wartime achievements. This metal holds still greater promise for the peacetime years ahead. That's why the manufacturer chose K&M "Century" . . . noted for its permanence and low maintenance cost.

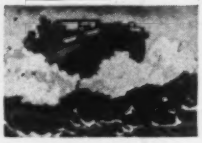
K&M "Century" Asbestos-Corrugated and Flat Structural Sheet Material offers *you* definite savings in building costs and maintenance costs. It is highly resistant to fire, corrosion and all kinds of weather. It combines the best qualities of two great building materials—asbestos and Portland cement.

K&M "Century" Corrugated Sheets in nineteen different sizes speed up construction, and its light gray color is pleasing and permanent. *It never needs paint for protection!* If your plans for plant expansion involve special problems, let Keasbey & Mattison, through its approved distributors, help you solve them with "Century" Asbestos-Corrugated and Flat Sheet Material.

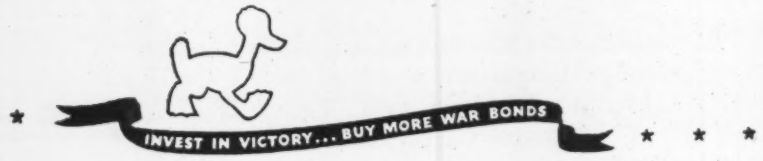
Our Ambler plants proudly fly the Army-Navy "E" flag with its star—an honor awarded K&M employees "for continued outstanding production of war materials."

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

Up from the Sea ...In "Ducks"



A new and secret weapon until a few months ago, the GMC "Duck" has now become a valued veteran of invasion campaigns from Sicily to the South Pacific. Part boat and part truck, it combines the performance and advantages of both. Loaded with fighters, food or fighting equipment, it can travel from ship to shore, and back again, with a simple shifting of controls. On land, the "Duck's" powerful engine and sturdy, six-wheel drive chassis carry it over regular road or tough terrain, right along with the famous GMC 2½ ton, "six-by-six" Army truck. In the water, chassis and tires add stability and seaworthiness to the big, buoyant, all-steel hull, making for "smooth sailing" in heavy surf and high seas. Since our earliest wars, America's fighters have gone *Down To The Sea In Ships*. This is the first time they have come *Up From The Sea In Amphibian Trucks!*



GMC TRUCK & COACH DIVISION
GENERAL MOTORS

Home of Commercial GMC Trucks and GM Coaches . . .
Volume Producer of GMC Army Trucks and Amphibian "Ducks"

Memphis, Tenn.; and General S... Co., of Canada, Ltd., ...tawa, Ont...

The directors of the Woodcrest ... struction Co. have elected William Goldsmith president, to succeed Joseph J. Elkin retired. Mr. Goldsmith has been treasurer of the company for the last seventeen years and was formerly commissioner of public works for Yon... N. Y.

C. O. Sutherland was elected ... president. He was formerly with ... Todd Shipyards Corp. and previou... that, in the construction industry ... twenty-seven years. Fred Golds... was elected secretary. The comp... has just completed a large additio... the Naval Training Station at Sa... son, N. Y., and prior to that the WA... Camp at Des Moines, Ia., comple... in 60 days at a cost of about two ... a half million dollars.

James D. Chamblee, manager ... sales and steel erection of the Ro... Sherman Transfer Co., Hartf... Conn., has been elected secretary. ... has been associated with the comp... since 1931, and was previously w... the George A. Fuller Co., general o... tractors.

Announcement has been made by t... American Marietta Co., Chicago, ... the purchase of the 67-year-old Sew... Paint & Varnish Co. with plants ... Kansas City and Dallas. This is p... of an expansion program which w... include the construction of new fa... tories and the enlargement of pres... facilities when restrictions are lift... Officers of the new subsidiary are A... bert C. Bale, with Sewall for 43 yea... president, and E. Ross Kyger, wi... Sewall since 1910, vice president a... general manager. Kyger also serves ... president of the Sewall Paint & Varni... Co. of Texas, and O. C. Johnson ... general manager.

When Irving Horine left the Sta... University of Kentucky in 1909 after majoring in mechanical engineering, he joined the Mengel Company as a draftsman. Today, after 35 years,, he is a vice-president in charge of the plywood and related materials division which ...

"SERVICE-ABILITY"—

Proven by Years of Performance!

"SERVICE-ABILITY"—
It's a new word. But it most exactly describes **CLEVELAND TRENCHERS**

• Many "Clevelands" built 15 to 20 years ago are still on the job today doing their part to ease the manpower shortage. • Although out-moded by "Cleveland's" modern standards of performance, this evidences the soundness and correctness of the basic design pioneered by Cleveland. • It also tells the story of "Cleveland's" policy of rendering prompt repair parts service even on these old machines. • This kind of service and this kind of ability are two more reasons why "Clevelands" continue to be the profitable long range investment in the trenching machine field.

Guarantee yourself this "Service-Ability" in your Post-War trenching jobs by using Clevelands.

THE CLEVELAND TRENCHER COMPANY
20100 ST. CLAIR AVE. *"Pioneer of the Small Trencher"* CLEVELAND 17, OHIO

"CLEVELANDS" Save More . . . Because they Do More

FLOORS that make LIGHT MORE EFFECTIVE

Light-Reflecting Floors made with Atlas White cement make seeing easier.

Light-colored floors, since they are close to work areas, may have even greater influence on the effectiveness of lighting systems than do light-colored walls and ceilings.

Dark floors absorb light and waste it. But light-reflecting floors made with Atlas White cement instead of gray cement, conserve light and reflect it back where it is needed. They reduce shadows and dark areas, and distribute light evenly throughout the whole working area. They reduce the contrast in brightness between the background and the task and thus make seeing easier and quicker.

Data on actual installations, lighting tests, costs and maintenance experience are found in the booklet "Light from Floors." For your copy write to: Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

ENR-F-27

ATLAS WHITE CEMENT
For Light-Reflecting Floors

braces veneer, plywood and hardwood lumber manufacturing plants at Baton Rouge, La.; Laurel, Miss., and Louisville, Ky. He also manages logging operations at the Baton Rouge and Laurel plants.

Henry J. Kaiser's Permanente Cement Co. has purchased stock of the Glacier Sand and Gravel Co. of Seattle, Wash., it was announced at Kaiser headquarters in Oakland, Calif. J. A. McEachern has been named president of the gravel company, and a Permanente employee, A. A. Dresser, will manage the firm's operations. Other officers are E. E. Trefethen, Jr., vice president; L. S. Corey, treasurer; and G. G. Sherwood, secretary.

International Harvester Co.'s industrial power division is a complete division with its own sales organization. H. T. Reishus is general manager and Neal Higgins is manager of sales, and G. A. Gilbertson and W. M. Parrish are assistant sales managers.

H. T. Reishus

Other managers include: D. B. Baker, engineering; H. B. Rose, manufacturing W. M. Holland, supply and inventory; and M. L. Allen, divisional comptroller. The sales department will function under Mr. Higgins, with the two assistant sales managers, and R. C. Flodin as assistant to the manager.

Neal Higgins

The company's tractor works in Chicago and Milwaukee are the industrial power division plants. J. W. Phillips is general superintendent of Tractor works, and R. E. Bloye has the same position at Milwaukee Works.

The Philadelphia district sales offices of the explosives department of Atlas Powder Co. have been moved to the Empire State Building, New York City. Explosives sales offices formerly at 60 East 42nd St., are being moved to the new location. A sales office is being maintained at the old address in Philadelphia. W. C. Manning, assistant director of sales of the explosives department is transferred from the general offices at Wilmington, Del. to take charge of the new offices, succeeding E. W. Moorehouse, who will retire July

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VIBRATORS
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CONCRETE GRINDERS

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FRONT END SHOVELS
for Industrial Tractors
HEATING KETTLES
for Asphalt and Tar
AGGREGATE DRYERS
for Stone and Sand
ASPHALT PLANTS
Portable — Stationary

Write for Circulars

White Mfg. Co.
ELKHART INDIANA

When There's No Time for Breakdo... It's Time to Get a Gorman-Rupp Pu...

Today, when time is the essence, you need a Gor... Rupp Self-Priming Centrifugal Pump more than e... There is not a quitter among them. The water pas... has the same area as the suction hose. Muck, gr... cinders—you simply can't clog them because solids c... not accumulate. There is no recirculation orifice to c... —no shut-off valve to jam—no hand priming requi... There isn't a self-priming centrifugal pump made ... will outwork a Gorman-Rupp in gallonage or contin... hours. Gas engine or electric motor driven. Capacitie... to 120,000 GPH. There is a type and style to fit y... every requirement. Stocked for immediate delivery in... principal cities.

THE GORMAN-RUPP COMPANY
Mansfield, Ohio

GORMAN-RUPP
Self-Priming Centrifugal Pump

TOKYO GANGPLANK

Here's one of the big reasons why rope must be conserved, today, here at home . . . so much of it is needed by our amphibious fighting men. Many will take their first steps toward Tokyo down a landing net made of Plymouth Rope.

Rope should be handled with the right kind of care. Treat it right to make it last as long as possible. And, help us spread the story of ROPE CONSERVATION—write for free copies of the W. P. B. Sponsored booklet, "The Rope You Save Fights For You."

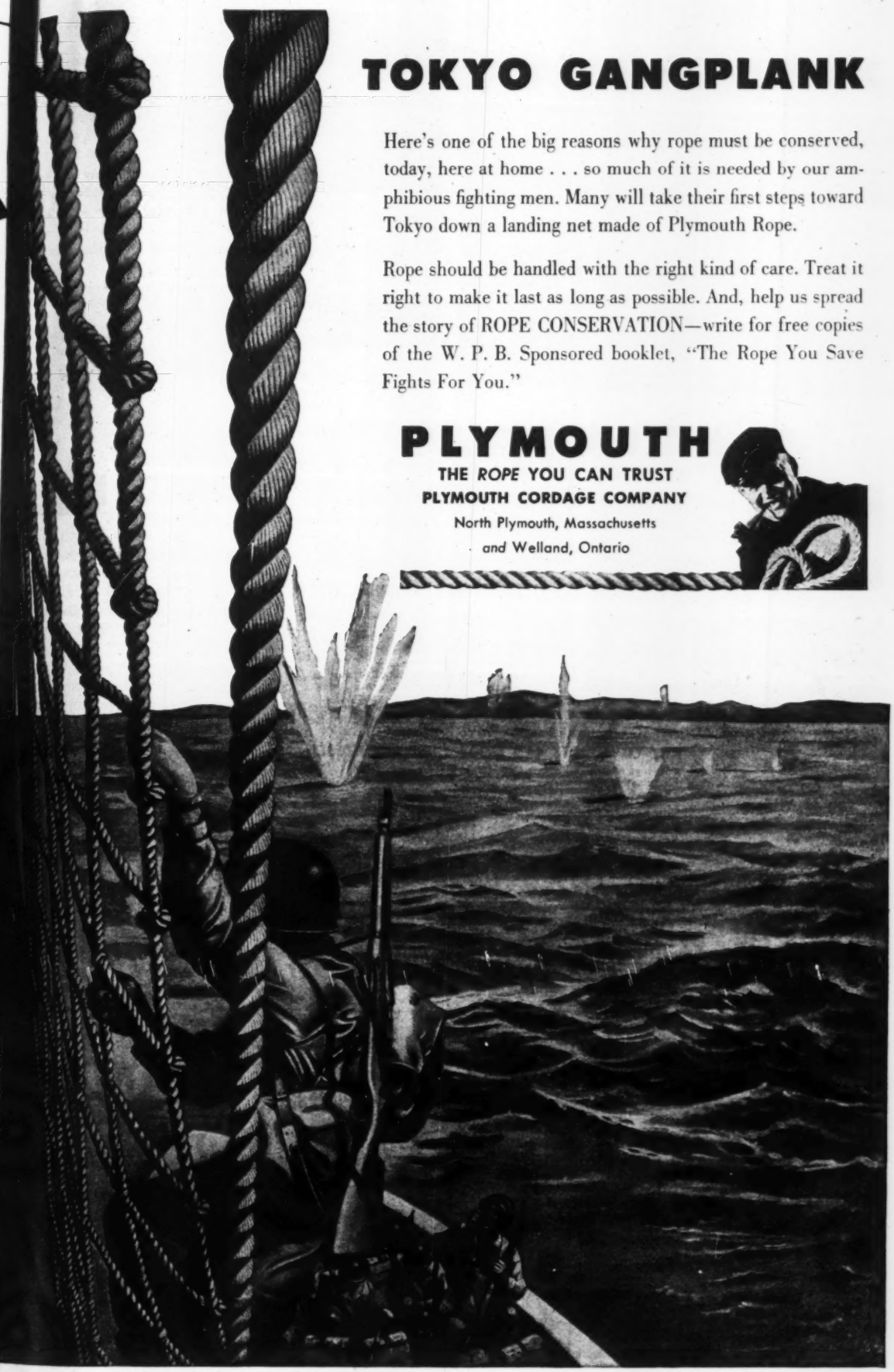
PLYMOUTH

THE *ROPE* YOU CAN TRUST

PLYMOUTH CORDAGE COMPANY

North Plymouth, Massachusetts

and Welland, Ontario



CENTRAL HEATING IS THE IDEAL SYSTEM FOR THE MODERN COMMUNITY

Mark up another contribution of the war toward better living in the future! Intelligent post-war community planning now fully recognizes the advantages of central heating: making it possible to purchase heat as a commodity like gas, electricity, or city water *at savings of 15% or more:* A powerful impetus has been given to this movement by the experience of central heating in war housing developments. The Elizabeth Park Housing Project in Akron, illustrated above, is a case in point.

RIC-WIL CONDUIT CONNECTS DWELLINGS TO CITY STEAM MAINS 2000 FT. AWAY

Welded into a single piece 700 feet long, this pipe was lowered into the shallow trench beside it, a section of the 2000 foot connection to the city main.

This project, comprising 276 family units is heated by steam supplied by Ohio Edison Company, Akron, Ohio utility. In addition to the 2000 feet of Ric-wiL Insulated Pipe Units connecting the project to the city mains, another 7000 feet are used for steam, return and hot water lines on the project itself. Conduit was furnished complete with prefabricated field accessories and installed in record time—with minimum interference with other construction. The completed piping system is efficient, dependable and maintenance-free, enabling the utility to serve the project with steam at rates considerably under the cost of individual heating plants.

ANY COMMUNITY CAN ENJOY THESE ADVANTAGES:

- Savings of 15% or better in overall fuel consumption.
- Elimination of furnace or boiler tending by consumer.
- Promotes cleanliness in buildings heated.
- Provides extra room in building basements.
- Decreases fire and explosion hazard.
- Reduces smoke and soot, provides cleaner, healthier community.
- Eliminates private coal delivery and ash removal.
- Gives uniform, clean heat quickly, whenever needed.

For information about Ric-wiL Conduit for central heat distribution get in touch with your nearest Ric-wiL agent or write to us direct.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

1 after forty-four years with the ex
sives industry.

Mr. Manning entered the explo
industry 25 years ago, starting a
salesman in 1919 with the old A
Explosives Co. He joined the Gras
Powder Co. in 1922, and was
Peerless Explosives Co. from 192
1931, when that company was acqu
by Atlas. He was located at the Wil
Barre, Pa., anthracite sales office
Atlas from then until 1942, when
was transferred to Wilmington.

After 27 years of service with B
ber - Greene Co.,
Aurora, Ill., practically all of that time as secretary, D. G. McIlwraith has announced his retirement, to take place in the very near future. For the past two years, much of Mr. McIlwraith's time has been taken up with the o
building expansion program
Aurora. John M. Spence has b
elected to the board of directors
as secretary. He joined Barber-Gre
in 1918 and for the past 25 years
been chief auditor.

BUILDERS-PROVIDENCE, INC., manu
turers of flow metering and controll
equipment, announces that E. W. G
formerly located in the Philadelp
office, is now associated with G.
Jewell, 1852 Peoples Gas Building, C
cago.

TO SERVE better the Toledo indust
area on broaching and to extend a m
complete broaching service, Colon
Broach Co., Detroit, Mich., has ope
branch offices at 1506 Toledo Tr
Building, Toledo, Ohio. The offices w
be in the charge of Morris Teague a
W. F. Haverstock.

DRILLING
ANYWHERE

We look into the earth

PENNSYLVANIA DRILLING COMPANY
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ENGINE DRIVEN DREDGE PUMPS
Close Coupled-Timken Bearings

Write for New Bulletin No. 45

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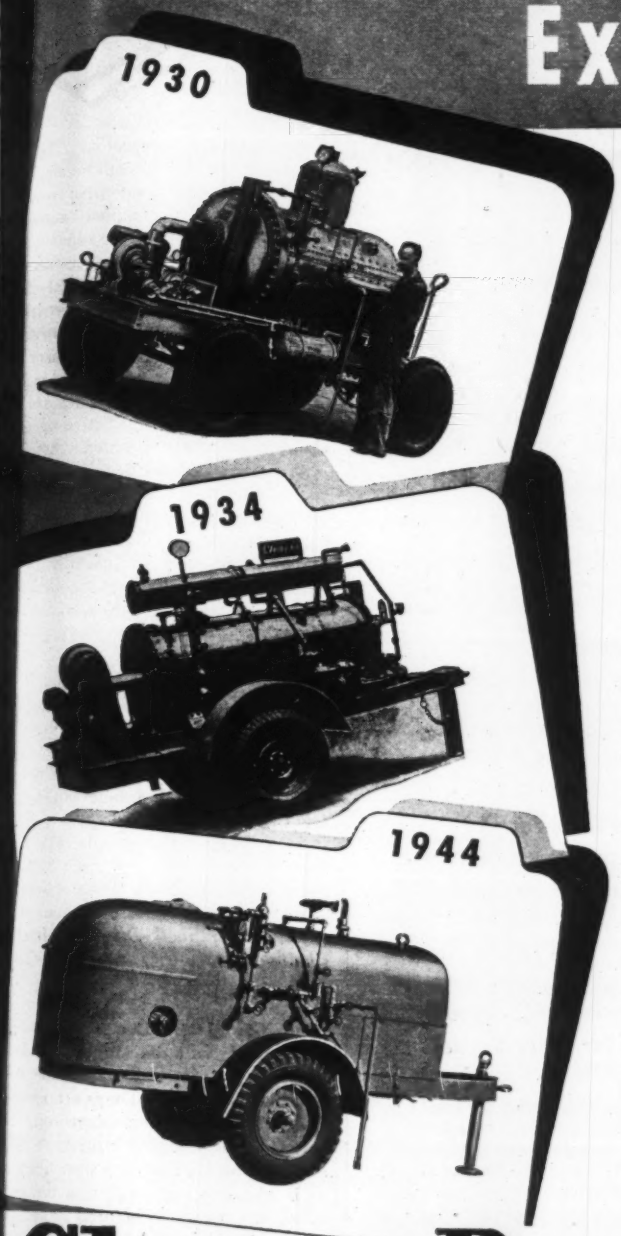
Hayward Buckets

Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.
THE HAYWARD CO., 48-50 Church St., N. Y.

YEARS OF SPECIALIZED EXPERIENCE . .



— An Advantage That Has No Substitute In The Design and Construction of Mobile Heating Equipment

THE familiar expression "there is no substitute for experience" is exemplified in the trim, streamlined, highly perfected Cleaver-Brooks Tank Car Heater of today.

It shows unmistakable evidence of being the product of years of specialized experience dating back to the pioneer model of fourteen years ago. At the time this unit quickly replaced cumbersome "boilers" — set a high standard of speed and efficiency in heating bituminous material in tank-cars. Most of these original Cleaver-Brooks units are still in service—a real testimonial to inherently sound design and construction.

Experience counts — it is one of many reasons why Cleaver-Brooks is the best known name in mobile heating equipment. No other equipment equals Cleaver-Brooks in providing steam—with less fuel and water—no other equipment has the original and exclusive four pass down-draft flue travel and integral fuel-oil burner construction, plus the *perfected* positive dry-coil method of condensate return, which ends the "water-wagon" problem.

Get complete information now—send for bulletins or see your Cleaver-Brooks distributor.

CLEAVER-BROOKS COMPANY
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Cleaver-Brooks

PIONEERS AND ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM-PLANTS

When shipments are ready—

LET 'EM GO!

WHEN AIR EXPRESS shipments are allowed to lie around waiting for end-of-the-day pick-up, you're throwing away a chance for earlier delivery. *Ship when ready!* Call AIR EXPRESS the instant the label is on. This saves your shipment from running the gauntlet of end-of-day congestion at the airport, assures earliest possible delivery at destination. Remember: when they're ready—*let 'em go!*

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As a result of increased efficiency developed to meet wartime demands, rates have been reduced. Shippers nationwide are now saving an average of more than 10% on Air Express charges. And Air Express schedules are based on "hours", not days and weeks — with 3-mile-a-minute service direct to hundreds of U.S. cities and scores of foreign countries.

WRITE TODAY for "Vision Unlimited"— an informative booklet that will stimulate the thinking of every executive. Dept. PR-6, Railway Express Agency, 230 Park Avenue, New York 17, N. Y., or ask for it at any local office.

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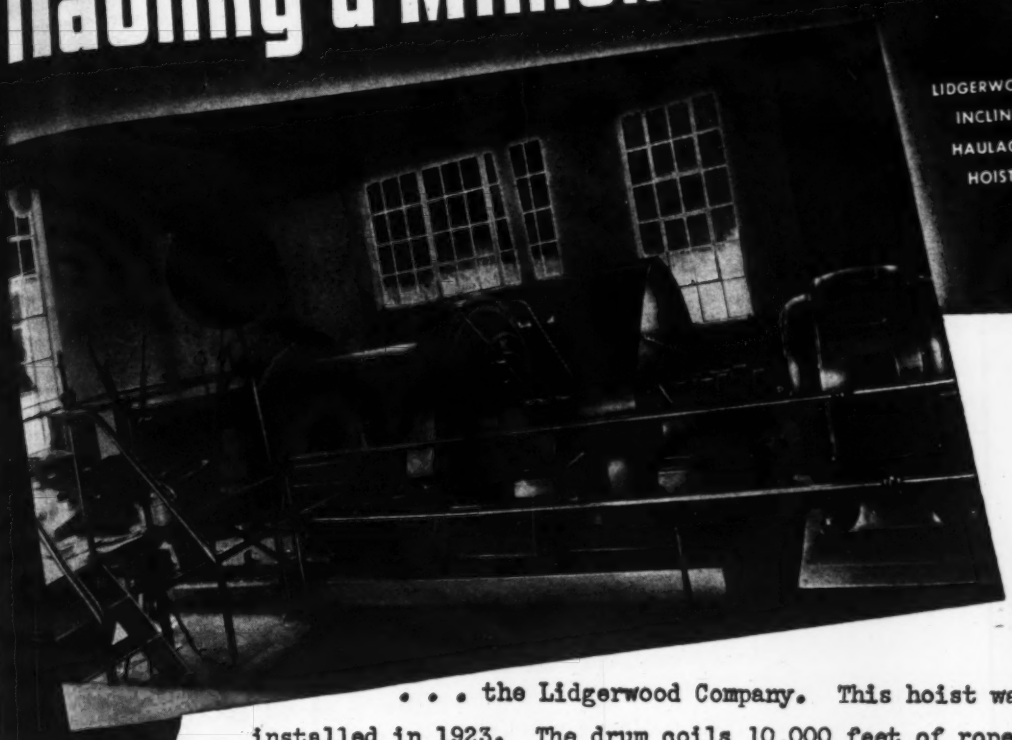
Management Control — The [illegible] presented in this brochure are [illegible] on several years intensive resea[illegible] They provide a complete answe[illegible] many of the pressing administra[illegible] problems faced by every business [illegible] ecutive today—positive control of [illegible] panded operations, of conversion [illegible] facilities for the accelerated produc[illegible] of war products, and of the many [illegible] sequent complexities presented in p[illegible] ning post-war manufacturing and [illegible] tribution activities. Effective opera[illegible] answers to these problems are il[illegible] trated and described in this tre[illegible] which presents the latest method[illegible] controlling production, material, [illegible] curement, personnel, sales and acco[illegible] ing systems used successfully by [illegible] of the country's most prosperous b[illegible] ness organizations. — *Remington-R[illegible] Inc., Buffalo 5, N. Y.*

Abrasive Milling—Each page in [illegible] catalog is a complete unit giving d[illegible] and specifications. All features [illegible] brought out, specifications are cle[illegible] outlined, a typical job is explained [illegible] described in detail, and several pict[illegible] are used to illustrate the key poi[illegible] It is a handy reference book for p[illegible] duction and purchasing men and e[illegible] neers who want to keep posted [illegible] abrasive cutting developments. — *[illegible]drew C. Campbell Division, Ameri[illegible] Chain & Cable Co., Inc., Bridgepor[illegible] Conn.*

Sand, Gravel and Ore Washing—[illegible] washers of both the single and dou[illegible] screw type are built and operate[illegible] told in this booklet. There are specifi[illegible] tions and engineering drawings. P[illegible] material washers are pictured and sh[illegible] remover installations are described, a[illegible] as is also the log washer, a device [illegible] breaking down cemented aggrega[illegible] tough clay, conglomerates and so[illegible] types of soft stone.—*Eagle Iron Wor[illegible] Des Moines, Ia.*

Timber Connector Construction—[illegible] signers using the timber connec[illegible] method of construction will find va[illegible] able a new design manual for tim[illegible] connector construction. The 40-p[illegible] book offers complete design informat[illegible] including data on load values, spacin[illegible] etc. The material is in chart form [illegible] ready use of architects and engine[illegible]

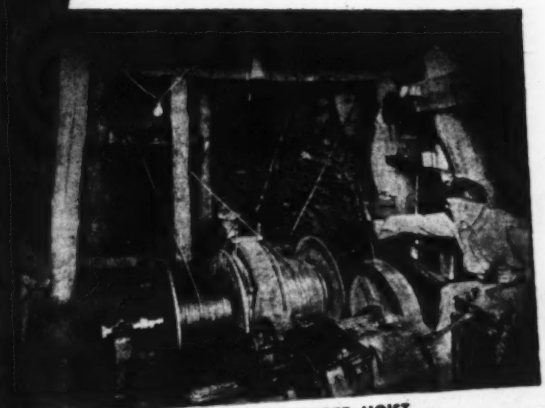
Hauling a Million Tons of Coal



LIDGERWOOD INCLINE HAULAGE HOIST

. . . the Lidgerwood Company. This hoist was installed in 1923. The drum coils 10,000 feet of rope, and has operated on an underground haul 7,000 feet long and has given very good performance. We think that in the years since 1923 we have hauled about a million tons of coal with this hoist. The maintenance costs have been very low, the operation smooth, and the hoist has been in every way satisfactory. It hauls coal from a mine which was opened in 1882 and has been in steady operation.

PROOF by performance over the years is the soundest recommendation of Lidgerwood hoists, which have a 70-year record of dependable, efficient and economical operation in mine, quarry and construction service. Lidgerwood hoists are built to *fit the job* —and at present Lidgerwood is supplying gasoline, steam, electric and Diesel hoists to the government and war-related industries.

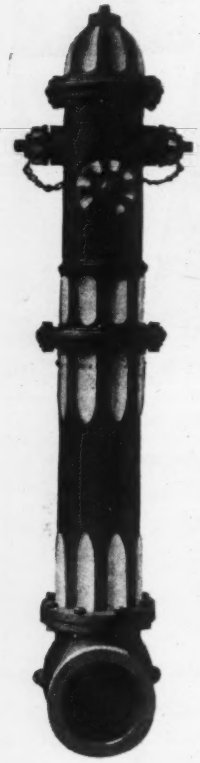


LIDGERWOOD SCRAPER LOADER HOIST

LIDGERWOOD
ESTABLISHED 1873
Manufacturing Company
MAIN OFFICE AND WORKS • ELIZABETH, NEW JERSEY

MUELLER-COLUMBIAN - THE ACCEPTED STANDARD

"WHAT ? NO SHOVEL ?"



"Do you mean that if I switch to MUELLER-COLUMBIAN Fire Hydrants that I won't ever have to dig them up again? Not even for repairs or repacking?"

That's right, Mister! When you install a MUELLER-COLUMBIAN Fire Hydrant it is there to stay. The self-oiling top keeps everything in the bonnet working smoothly. Can't leak, rust, or bind. If a truck smashes the hydrant, only the safety-flange and coupling part. No damage to anything else. No flooding. No digging. One man in half an hour can fix it like new again. Grade levels or nozzle changes can be met readily with the extension sections. Quickly assembled without water shut-off. The main valve is easily removed anytime for inspection. Bronze threads on seat ring cannot rust or stick. Double bronze-bushed drain valves keep barrel dry. Stops rusting or freezing. No, sir! You'll never need to dig up one of these hydrants.

The MUELLER-COLUMBIAN Gate Valve has similar advantages. The ball-joint packing gland mechanism will not bind or leak. Permits packing to be changed anytime—whether valve is open or closed. Four-point wedging feature of gates provides water-tight closing without warping discs. Entire gate assembly can be removed for check-up without digging up the valve. . . Do as hundreds of others have done. Change to the MUELLER-COLUMBIAN line of water control equipment.

MUELLER CO., CHATTANOOGA 1, TENN.

Mueller-Columbian FIRE HYDRANTS

and includes such additional information as recommended camber for standard trusses, approximate weights of various timber connected roof trusses and a table of dimensional properties of American standard-size lumber. The data presented are drawn in accordance with the recent WPB *National Emergency Specifications for the Design, Fabrication, and Erection of Structural Grade Lumber and Its Fastenings* which became mandatory on November 1. *Timber Engineering Co., Washington, D. C.*

MEN AND JOBS

(*Continued from page 1404*)

Alvin M. Martin has been engaged by the Texas highway department's bridge division, as architectural bridge draftsman. He was with Consolidated Aircraft in Fort Worth.

R. L. Schmidt, assistant to the state highway engineer of Texas, **R. Bowen,** assistant urban planning engineer, **W. R. Averyt, Jr.,** design engineer, road design division, and **E. Burks,** accounting division, have successfully passed their physical examinations for military service and are awaiting their calls.

Robert O. R. Martin, associate hydraulic engineer for the U. S. Geological Survey, has been transferred from the sub-office of the water resources branch in St. Louis, Mo., to the district office in the Hydraulics Laboratory of the Iowa Institute of Hydraulic Research, Iowa City, Ia.

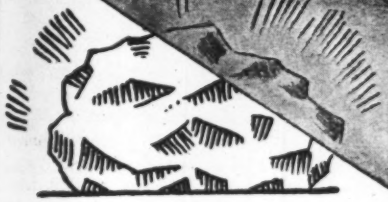
Paul C. Benedict, associate hydraulic engineer, water resources branch, U. S. Geological Survey, has been detailed temporarily from the Iowa City district office for a special assignment in the headquarters office, Washington, D. C.

Capt. Fred Houston, an engineer at the Sioux Ordnance Plant at Sidney, Neb., has been transferred to Pierre, S. D.

Five engineers of the Civil Aeronautics Board who have been at Greenville, N. C., constructing new runways at the County-City airport have been transferred. **Robert C. McGinn,** engineer in charge of the testing laboratory which was operated for the Greenville, Washington and Kinston airports, has been transferred to Troy, Ala., as has **Johnson. Lester Walker** has been transferred to Titusville, Fla., and **Vincent J. Regewin** to LaGrange, Ga. **Allen Wolf,** who has been an engi-

Albanene

the Stabilized TRACING PAPER



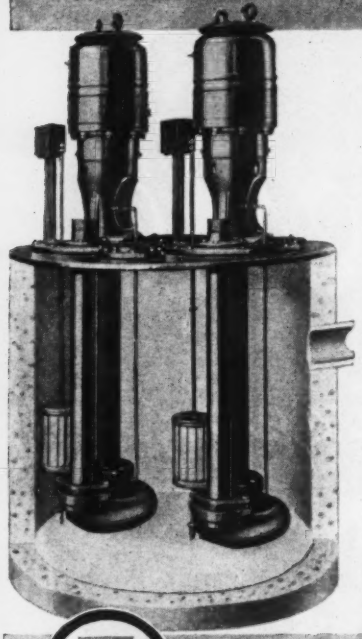
★**STABILIZED** to keep its toughness and transparency — that's Albanene Tracing Paper. Because it is treated with crystal-clear Albanite, a new synthetic solid developed in the K&E laboratories—Albanene will not oxidize, become brittle or lose transparency with age. Albanene's improved drawing surface takes ink or pencil fluently, erases with ease . . . Ask your K&E dealer.

TRADE MARK K+E

KEUFFEL & ESSER CO · *Est. 1867*

CHICAGO · **NEW YORK** · **HOBOKEN, N. J.** · MONTREAL
ST. LOUIS · SAN FRANCISCO · LOS ANGELES · DETROIT

This NON-CLOG SEWAGE EJECTOR
... DOES AWAY WITH SCREENING AND CLEANING!



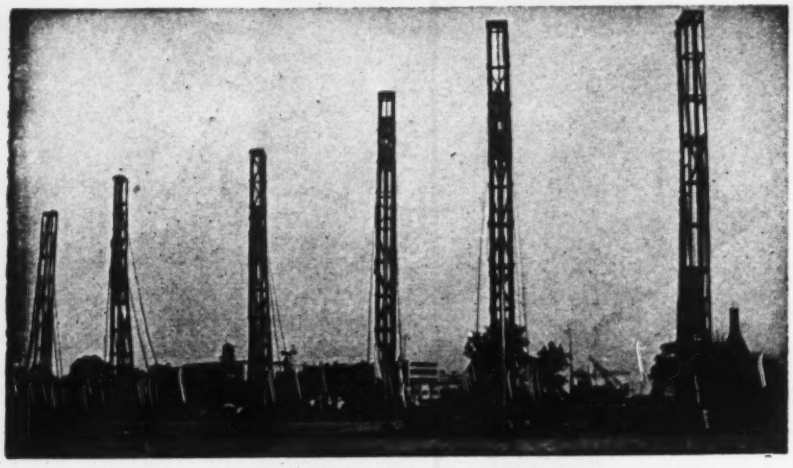
Here, again, Economy design improves pump performance and *cuts maintenance costs* by eliminating need for strainers, and disagreeable job of cleaning them.

The wide Economy impeller has smooth, clear passages that allow solids and rags to pass without danger of catching or clogging, an important advantage in the handling of domestic or industrial sewage, solids, or pulpy materials. Economy Sump Pumps are able to *sustain* high rated efficiency with minimum attention, by virtue of these additional engineered features:

• Heavy duty patented shock absorber immediately above runner. • Oversize bearing surface above impeller at point of greatest strain and wear. • Replaceable ground steel sleeve eliminates wear on shaft. • All joints accurately registered to insure perfect alignment. • High pressure grease feed to all bearings with single gun. • Capacities from 50 to 4000 G.P.M. with heads up to 120 feet.

These and many other Economy advantages are fully described in free literature. Economy's Engineering Service will gladly help you to select correct pumping equipment.

ECONOMY PUMPS, INC.
HAMILTON, OHIO, U. S. A.



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WESTERN CONCRETE PILE CORP.
DRILLED-IN CAISSON CORP.

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CHICAGO, ILL.

155 EAST 42ND ST.
NEW YORK, N. Y.

neer in the testing laboratory at Gr... ville, has been transferred to Kins... N. C., to serve in a similar capacity.

Gunnar Bernsteen has been nam... highway commissioner of Oneida, W... succeeding Harry P. Williams, who ... resigned.

Capt. Leonard W. Bindon, previou... resident engineer for the $11,000,... Auburn transit storage depot n... Seattle, Wash., for the U. S. Engine... has been appointed area engineer ... charge of military construction at Gr... Falls, Mont. He succeeds **Maj. Sid... Stern,** who was transferred to F... Leonard Wood, Mo. Also transferred... Fort Leonard Wood is **Major Adel... Hogan,** Fort Lewis area engineer ... Tacoma, who will be succeeded at F... Lewis by **Captain W. B. Matlock.**

Roy Nunn has resigned as Doug... County, Wash., engineer at Waterv... to accept the positions of Benton Cou... engineer and city engineer of Pros...

The United States Navy, Bureau ... Yards and Docks, has assigned ... **Commander Joseph White** as proj... manager in charge of construction ... the new Naval Ordnance Depot at S... Beach. Lieut. Commander White h... established temporary offices at 12... Security Building, Long Beach, Cal... adjoining the permanent offices of t... project architects., Graham, Probst, A... derson & White.

Maj. E. E. Gialdini has been nam... commanding officer of the Twin Cit... ordnance plant near New Brighto... Minn., succeeding Capt. V. A. Lufi, w... has been appointed control officer in t... army ordnance department small am... ammunition suboffice at Philadelphia. P... Major Gialdini comes from the D... Moines ordnance plant.

James I. Stober, Allison, Ia., has r... signed as Butler county engineer to a... cept a position with the sanitary eng... neering department of the state board o... health at Des Moines.

William D. Weidlein, consulting eng... neer at St. Paul, Minn., has signed ... contract with the Omaha Chamber o... Commerce to serve for one year as a... adviser to the postwar planning board...

D. J. Summerville, Ladysmith, Wis... highway engineer of Rush county for ... years, has been appointed a member o... the Wisconsin state highway commissi... to succeed William E. O'Brien who ha... been appointed state director of th... U. S. War Manpower Commission.

Oliver Hanson has been named Dea... county highway superintendent at Cle...

The Tractor that Brushes off a Jungle!

WHEN THE MARINES LAND . . . so do the Seabees armed with tractor bulldozers, *their favorite combat weapon.* To clear beach-heads for attack troops. To carve air-strips out of jungles. To lay roads over mountains. To drain swamps and build bridges. Yes, *sometimes even to fight!*

Like that time during a South Pacific landing . . . when strong Jap machine-gun fire held back everything except one man with a bulldozer, who charged in and with one sweep of the blade, cleaned out the nest and buried a dozen Japs.

Of such stuff are Seabees and their bulldozers made. And, like the men who man them, these blade-wielding tractors are built to "take it," where the going is tough. "Take it" they do, too, when they crack into rocks, butt into trees, bite into dirt, dive under water into mud and sand . . . or head into enemy fire.

Helping them stand up under the punishing shocks of load and impact are the husky, smooth rolling Hyatt bearings into which we build great stamina and capacity while holding them true to required precision tolerances.

Hyatts are liberally used to protect the vital operating parts of these ponderous machines of modern war. Tomorrow, these same high quality bearings will help you build better machines and hold competitive advantages in the post-war markets.

HYATT BEARINGS

DIVISION OF

GENERAL MOTORS

HARRISON, N. J.

Twenty-two REASONS
Why *FLEX-PLANE* Dummy Joints are Necessary in Modern Concrete Pavements

- Reduces the Number of Expansion Joints
- More Dummy Joints Divide Contraction Openings
- Prevents Cracking
- Retards Creeping
- Controls Warping
- Reduces Curling
- Relieves Stress
- Lessens Bumps
- Minimizes Pumping
- Minimizes Panning
- Lessens Deterioration
- Lowest Cost
- Limits Maintenance Cost
- Anchored in Place — Is Permanent
- No Extrusion
- Localizes Expansion and Contraction
- Assists in Normalizing the Slabs
- Ribbon Joint is Continuous in Length
- Prevents Infiltration of Water
- Increases Strength of Slabs
- Produces Homogenous Structure
- Provides Expansion Relief for the Hot Upper Part of the Slab

FLEX-PLANE joint installing machines eliminate messy hand methods. Install all types of joints . . . ribbon, poured, premoulded, etc., with or without VIBRATION.

• *Ask for Equipment Specifications* •

FLEXIBLE ROAD JOINT MACHINE CO. WARREN, OHIO U. S. A.

Lake, S. D., to succeed Carl J. Joh... who resigned recently after holding ... position for 20 years.

Capt. Fred Houston, formerly an ... neer at the Sioux ordnance plant, ... ney, Neb., has been transferred ... Provo, S. D.

Lewis H. Pennock has re-entered ... service of the Texas highway de... ment as junior design engineer, br... division, after an absence of one ... He was with the U. S. Engineers ... Fort Sam Houston.

R. L. Otto, who for the past ... months has been working on the ... American Highway, has reentered ... Texas highway department as dra... man with the bridge division. ... viously Mr. Otto was with the high... department for 12 years in the field.

Dwight E. Farr has recently bec... associated with the Texas highway ... partment, bridge division, as junior ... signs engineer. He previously was ... Texas Quarries in Austin, working ... South Texas.

George S. Brockway, on leave f... his post as city engineer of West P... Beach, Fla., has been commissio... Comdr., C.E.C., U.S.N.R.

Karl A. Miller, county engine... Meadville, Pa., has been named ... county zoning officer and chief asses...

James F. Moring, city engineer ... Evanston, Ill., has been granted le... and has been commissioned Li... (j.g.) C.E.C., U.S.N.R., Camp Pe... Va.

J. Franklin Perrine, retired engin... of sewers, Borough of Queens, N... York City, is now in consulting practi...

J. E. Root, resigned recently as ... rector of public works, Cincinnati. ... He had served since 1931.

Benjamin F. Rush, Comdr., C.E...

The "Buff" is built of metals that are so extremely hard that the shop cost to machine is trebled.

Rental Transits — Reasonable Rates. Send for handsome new catalog #491.

BUFF & BUFF INSTITUTE
J. P. Boston, Mass.

The BUFF "X" TELESCOPE has the finest and highest definition and simplest lens system. It is useful when the light is dim.

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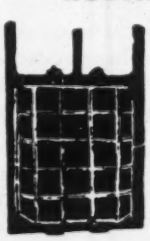
and
EXTRACTORS
HOISTS—DERRICKS
WHIRLERS
Write for descriptive catalogs
McKIERNAN-TERRY CORP.
13 Park Row, New York

RODNEY HUNT

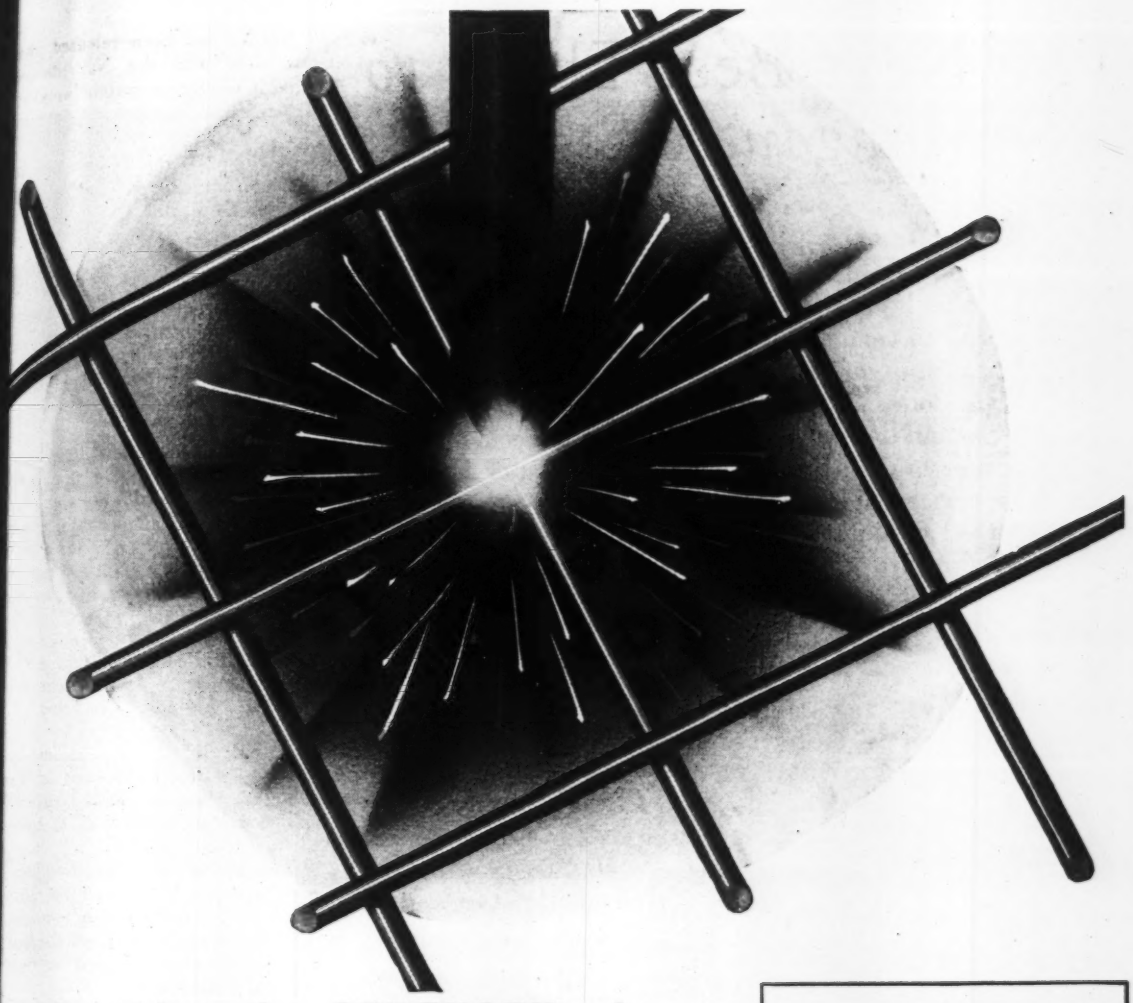


SLUICE GATES

Also flap and mud valves, shear and filler gates. Dependable equipment since 1840.

Write for Special Catalog Today

RODNEY HUNT MACHINE CO.
79 Lake St., Orange, Mass., U.S.A.



Consider the STRENGTH of CLINTON REINFORCING FABRIC

BOUT 25 centuries ago a wise old philosopher made the observation A that "union gives strength." Today he might have added, "as in nton Fabric." We take many strong, uniform wires, lay them in precise er, then weld them electrically to give Clinton Fabric STRENGTH.

That's how Clinton Reinforcing Fabric is made. We start with uniform el from our own open hearth furnaces, steel of such elastic and ductile perties as to make it especially adapted to the reinforcement of con-te. From open hearths, to wire drawing, to welding, each process is efully supervised to assure a product that is UNIFORM. Clinton bric has an ultimate tensile strength of not less than 70,000 lbs. per sq. h in accordance with A.S.T.M. Serial Designations A 82-34 and A 185-37. e strength of welds generally exceeds tensile strength of the wire itself.

Clinton Electrically Welded Fabric is the choice of many leading tractors and engineers. Try it on your next job and you'll know why.

WICKWIRE SPENCER STEEL COMPANY

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STANDS FOR FRIENDLINESS

Other Reasons for specifying CLINTON WELDED FABRIC

QUALITY—Automatic machines accurately fix members at right angles to coincide with lines of stress in concrete. Perfect wire and welds assure high, *uniform* tensile strength.

ECONOMY—No clips or ties to break or come undone. Uniformity of wire and perfection of welding speed handling, reduce hazards. Saves time and expense—even on tough, circular, reinforcement jobs.

CONVENIENCE—Available in a wide range of styles both in gauge and spacing. Delivered cut to size for easy storage, handling and use.

UTILITY—Used successfully and economically in every form of reinforced concrete construction.

PERFORMANCE—Years of experience show that when concrete roads, sewers, runways, levees, bridges and buildings are reinforced with Clinton Fabric maintenance costs are remarkably low.

The Next Best Thing *to* *Manganese Steel*

In ordinary times the owner of crawler-type tractors gets such long original life from manganese steel parts that "building up" to compensate for wear is an infrequent necessity. It *is* done, and economically too, but these examples of conservation welding with Amsco materials relate to carbon steel castings.

W-103 shows a driving sprocket after hard-surfacing the teeth for the third time with Amsco Economy Hardface. The total cost was $25.00 and the welded sprockets gave wear equal to that of new ones. No grinding was necessary, the track being full-floating so that when the original contour is restored, rolling friction rather than sliding friction occurs.

W-104 shows how round mild steel bars may be applied to badly worn tractor sprockets. The teeth wear thin and then spall off, causing the track to jump over them. By welding on a common reinforcing bar across the edges of the teeth and then applying Economy Hardface, these sprockets are reclaimed for one-third the cost of new ones.

W-103B, two crawler sprockets which were put into service at the same time are shown. The one on the left had been rebuilt with 1/4" Economy Hardface electrodes, and the one on the right was a brand new sprocket. The new one had worn to such an extent that it was necessary to resurface it with Economy Hardface, while the welded sprocket needed no repairs.

Ask for Bulletin 941-W on Amsco Welding Products and their applications.

The features of Amsco Renewable Lip Dippers are covered in Bulletin 641-D.

Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

U.S.N.R., has been released from tive duty with the Navy to be superintendent of public works of Territory of Hawaii.

William H. Smith has been na assistant director of public works Kansas City, Mo.

C. M. Stuart, assistant to the p dent of Carrier Corp., Syracuse, N has been granted a leave of absence become deputy chief of the sp equipment branch, General Indus Equipment Division, Office of Op tions of the War Production Board.

Lieut. Col. Erhard G. Teschan, served several years in the Caribb area and went on the inactive list M 9, has been appointed manager and gineer of the village of Shorewood, Milwaukee, Wis., succeeding H Schmitt, commissioned an army cap

Donald D. Leaman, a junior engi with the United States engineer's o at Milwaukee, Wis., has been com sioned an ensign in the Navy.

Joseph C. Hapgood, an inspecto the city water department of War Ohio, has been appointed superint ent to succeed the late C. E. Inman

Russell Sullivan, who has been the highway department for 15 ye has been elected highway commissio of Wood County, Wis., to succeed Brayback, who resigned to join Trott Tractor Co.

William Sutton, maintenance e neer for the Cheyenne district of Wyoming state highway department, been named division and equipment gineer.

Walter M. Smith, consulting engi for the Illinois State Division of Wa ways, has been elected a director of Metropolitan Water Co. of Chicag formed to furnish Lake Michigan w to about one hundred towns near C cago.

Major Temperance S. Davis, Jr., engineer at Camp MacKall, Richm County, N. C., since 1943, has been p moted to Lieut. Colonel. Prior to h he was post engineer at Camp Van D

Among employees of the Illinois di sion of highways who have recently tered the armed forces are Jos **Fessler, J. G. Uhlenhop, Otto Gerk John Spangler, Charles Calhoun, T Morf and C. S. Gill.**

Carroll L. Mann, Jr., of Rale N. C., has been promoted to Lieute

Making strong the things that make America strong

eeping a Jeep "out of hot water"
reezing" Timber Trusses on the job

EP absorbs terrific punishment as it the high spots and jolts to earth. It d be in trouble all the time if its bolts nuts didn't hang on to each other h bull-dog tenacity.

timber truss span is under strain, too particularly at the joints. Its bolts nuts must have a stubborn grip, but also important that their dimensions ccurate for quick assembly.

or strength that survives the stresses hock, vibration and pull . . . for ac- te mating that speeds up construction: standardize on RB&W fasteners.

It's not by accident that RB&W Empire products are so strongly established in the construction, farm implement, automobile, aircraft, railroad, power and transmission and general industrial fields. Their acceptance is the result of 99 years of purposeful planning . . . 99 years of relentless effort to develop equipment and processes for improving fastener properties . . . perfecting automatic cold heading and cold punching . . . creating new thread-forming techniques. And, still, pursuit of the maximum combination of strength, accuracy and finish continues.

New developments on the way will give further reasons why "RB&W" on your order means a step forward toward stronger construction and faster assembly.

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colonel at Fort Bragg, N. C., wh is post engineer.

Harold A. Buck of Enka, N. C. been promoted to lieutenant co from major at Fort Monmouth, N where he is plans and training offic the Eastern Signal Corps School.

W. O. Jones, director of the de ment of public works, Ft. Worth, has been appointed a member of airport committee of the American lic Works Association.

Capt. Leonard W. Bindin, for Fort Lewis area engineer, has been pointed Great Falls area engineer charge of military construction in M tana. **Maj. Adellon Hogan** was tr ferred from Fort Lewis to Fort Leon Wood, Mo.

Otto K. Jelinek has been promo from traffic to planning engineer of Chicago Park District. He will serv staff officer in the development of pl for the construction and extension parks and park facilities.

Donald D. Kennedy, Jr., has been ducted as a lieutenant (jg) of the Co of Supply, U. S. Navy. Mr. Kennedy had long experience on the construct field, having been head of the Kenne Cochran Co., of Chicago.

Robert M. Andrews is city engin of Harrisburg, Pa. He supervised work on the Harrisburg airport at N Cumberland, and sanitary engineeri flood control projects, and steel m construction in New York, Connecti Ohio, Massachusetts, Pennsylvania, K tucky and Bermuda.

L. F. Harza, president of the Har Engineering Co., Chicago, has gone Montevideo, Uruguay, to take charge the engineering for the completion the Rio Negro hydroelectric proj (*EN-R*, Dec. 16, 1943, p. 904). T project, designed for an ultimate c pacity of 121,600 kw., includes a m tiple-arch concrete dam 130 ft. high m 3,850 ft. long. It was started by Germ engineers before the war, and wh Uruguay broke relations with the Axi powers in July, 1942, the United State Export-Import Bank loaned Urugu $12,000,000 to complete the job. Fo American firms—General Electric C Westinghouse Electric & Mfg. Co., Morgan Smith and General Cable C —are now supplying equipment m materials for the project. Construct is by local contractors.

Appointment of **R. C. Perkins,** di trict engineer, to succeed Fred N. Ha as deputy state engineer was announc

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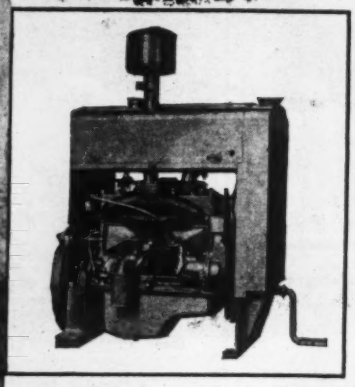
WAUKESHAS IN WAR WORK "somewhere in Alaska"



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WAUKESHA ENGINES

recently by State Engineer B... Touhey of Arizona.

Roger Moehlman is sanitary en... for Harris County, Texas. He... Texas A. and M. civil engineering... uate who majored in sanitation.

James L. Stober, Allison, Ia., ... signed as Butler County engine... join the sanitary engineering d... ment in the Iowa state health divis... Des Moines.

Charles E. Vail, formerly emp... by the Kimberly and Clark Pape... has started training as an aviation ... in the army air forces at Yale. H... a civil engineering graduate of ... State college in 1941.

Merle E. Reed, construction en... for the American Steel and Wire... Gary, Ind., and an Iowa State gra... in civil engineering in 1932, has ... commissioned a lieutenant (j.g.) ... U.S.N.R. and is stationed at Gul... Miss.

William F. Freeman, of High ... N. C., is consulting engineer on t... stallation of additional water and ... lines at Jacksonville, N. C.

Lt. Col. Samuel G. Neff, Denis... trict Army engineer, chief of the ... tions department at Denison, Tex... been made district engineer at ... dence, R. I.

Edward A. Dodson, former me... of the Texas state board of water ... neers, has been promoted to major ... captain at the Army Air Forces we... wing at Asheville, N. C., where ... commanding officer of headquarters ... headquarters squadron.

W. M. Franklin, superintende... water and sewage plants at Char... N. C., since 1936, has been co... sioned a captain in the Army San... Corps and has reported to Carlisle ... racks, Pa., for active assignment.

His work in Charlotte is being ca... on under the supervision of W. E. ... superintendent of the city water ... partment.

Franklin obtained his B.S. de... in civil engineering from the Unive... of North Carolina in 1926 and his ... in 1929. He helped design and ... Charlotte's sewage disposal plant ... later served as city sanitary engi... at Durham, N. C., returning to C... lotte in 1936 as superintendent ... plants.

Frederick Lienhard, an associat...

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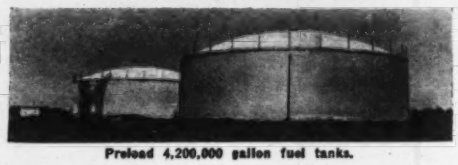

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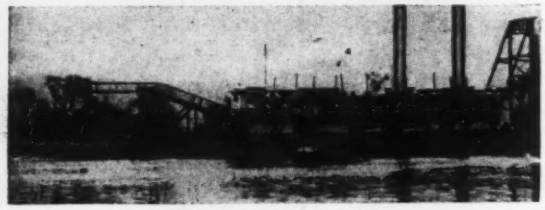

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the late Leon S. Moisseiff, has nounced the opening of an office as sulting engineer on bridges, struct and metals at 99 Wall Street, New Y 5, N. Y.

Melvin H. Boots, for the past y associated with the Mobile dist United States Engineer Office, as sistant construction engineer, has signed to accept his former posit with the bridge engineering departm of the Mississippi State Highway partment, Jackson.

E. K. Burton has resigned as manager at Silverton, Ore., a posit he has held since 1941. Formerly was city engineer at Marshfield, O Burton has not announced his plans the future.

William D. Darby, consulting en neer and former city engineer of W Allis, Wis., has been appointed chief the division of manpower utilization the Wisconsin state War Manpo Commission. Mr. Darby has had years experience in engineering.

Fred Essing of Tacoma has been appointed chief engineer of the Int county River Improvement Commissi of Pierce and King counties, Wa **R. E. Thompson** of Seattle was appointed consulting engineer.

Assignment of **Maj. Deming W. M rison,** formerly stationed at Sacramen Calif., to Salt Lake City, where he w succeed **Lieut. Col. Ben Benioff** as a engineer, has been announced by U. Army Engineers. Colonel Benioff w transferred to the office of the divisi engineer, Pacific division, with hea quarters in Salt Lake City.

Prior to receiving his commission the spring of 1942, Major Morrison w a civilian engineer for the Army En neers in the Los Angeles district. H was graduated in engineering fr Stanford University.

Sergt. Julian Taylor returned r cently to the department of bridge Springfield, Ill., where he had previous given nineteen years of service. Sin 1942, he had been in the 112th Re ment dismounted cavalry, spending co siderable time in Australia and so Pacific islands. He will be engineer aid.

George H. Haley, who has been d trict highway engineer at Bowli Green, for the Kentucky Highway Co mission, has been named rural highw division head. Dewey Sparks, at pr ent assistant engineer of the depa ment in the Louisville district, will place Haley at Bowling Green.